EVS

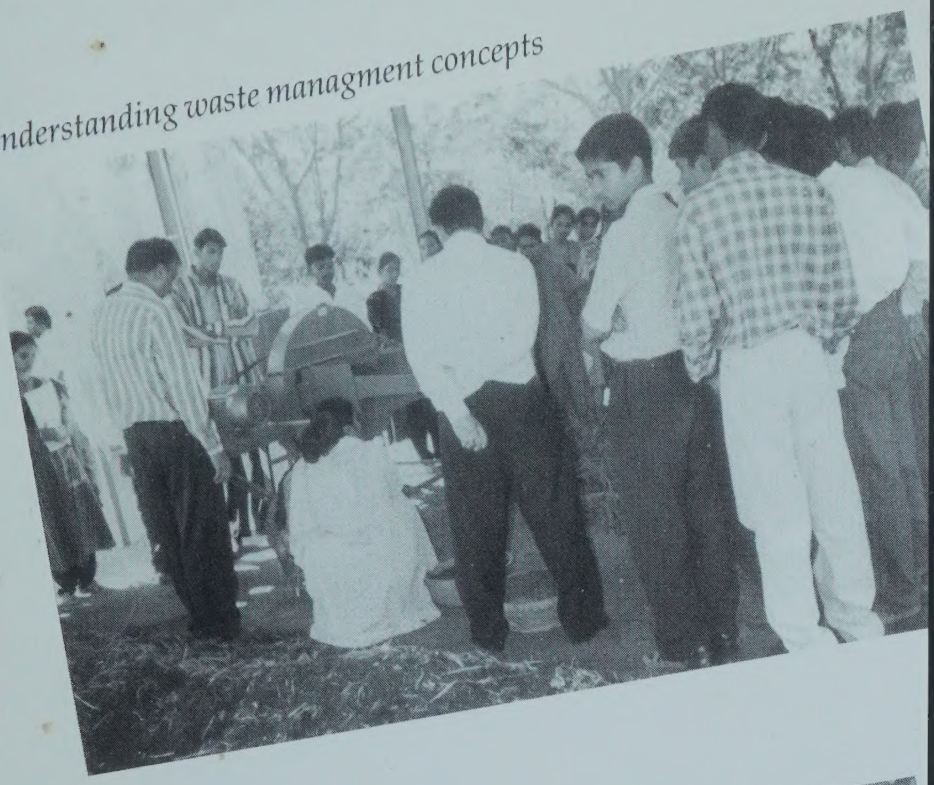
Garbage to Gardens

SKM-54

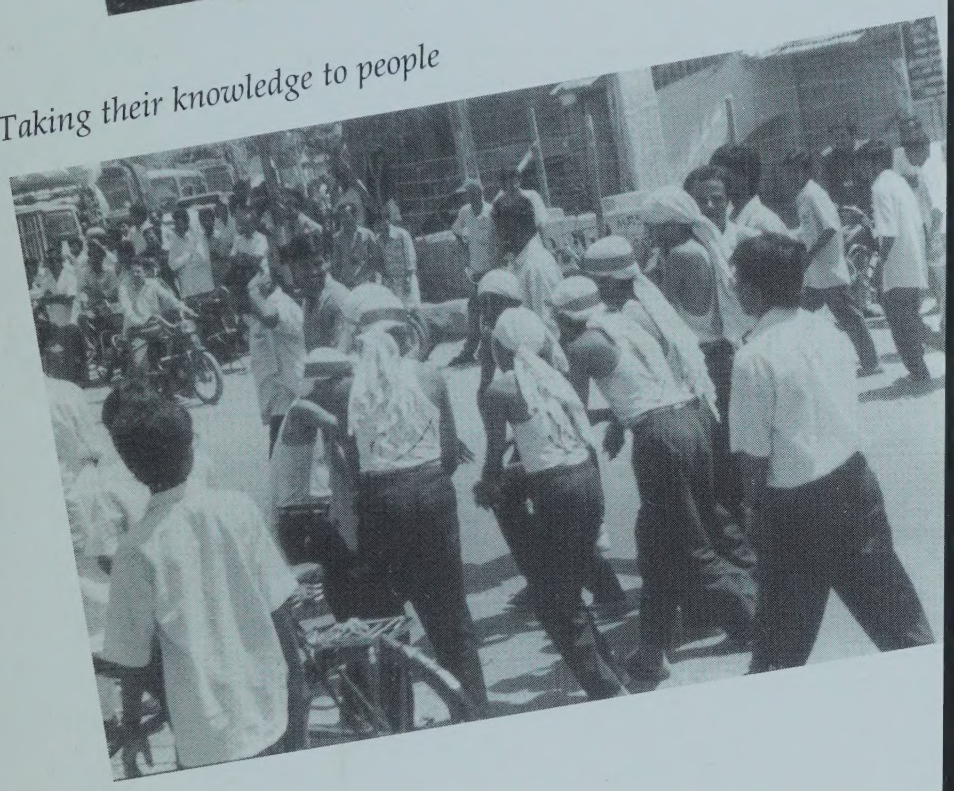
An Activity Booklet on Solid Waste Management for Schools

Centre for Environment Education, Southern Regional Cell,
143, Infantry Road, Bangalore 560 001
H.O. : Centre for Environment Education, Thaltej Tekra, Ahmedabad 380 054

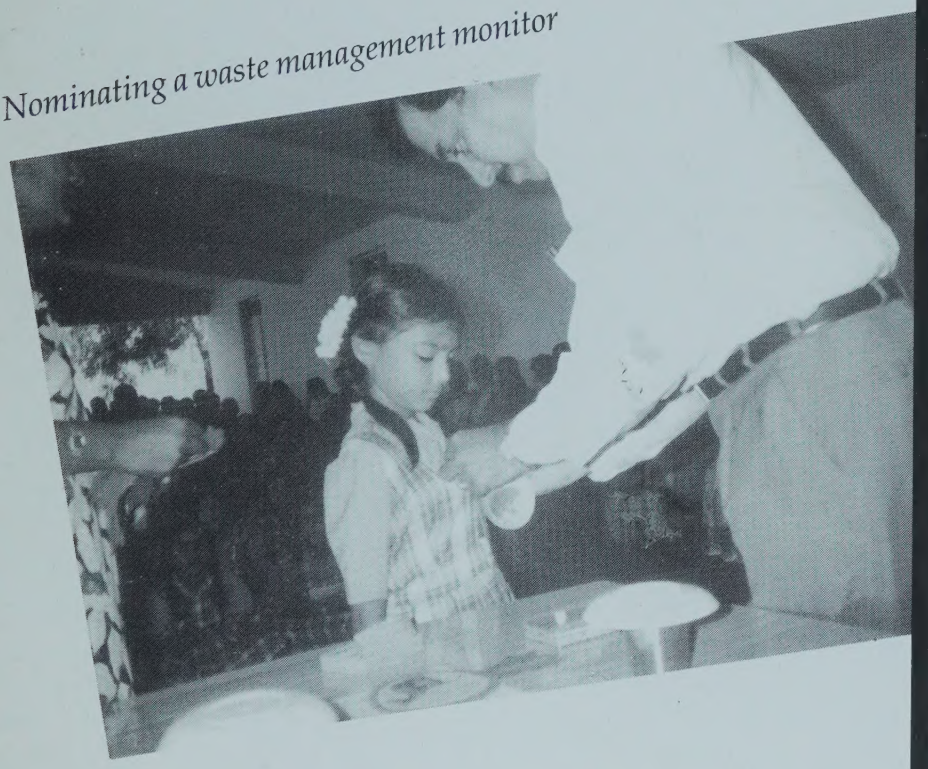
Understanding waste managment concepts



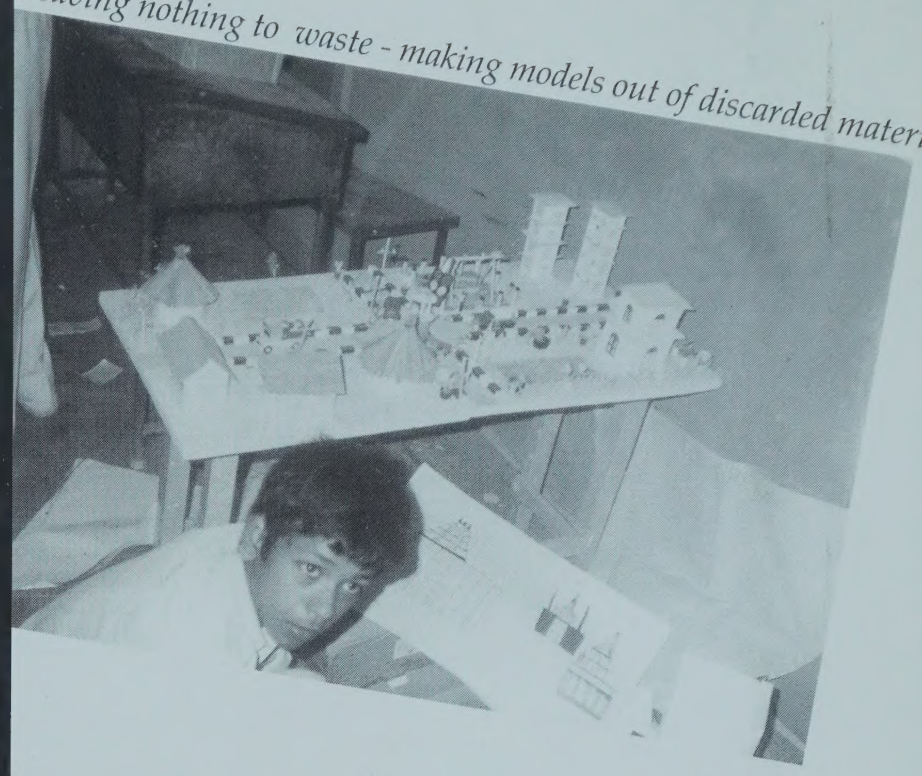
Taking their knowledge to people



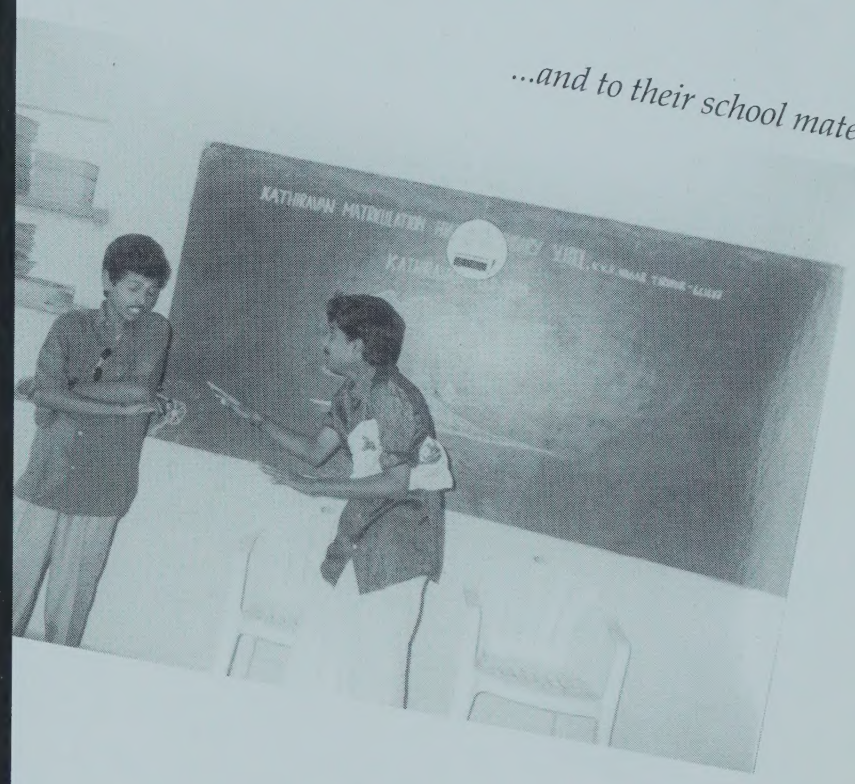
Nominating a waste management monitor



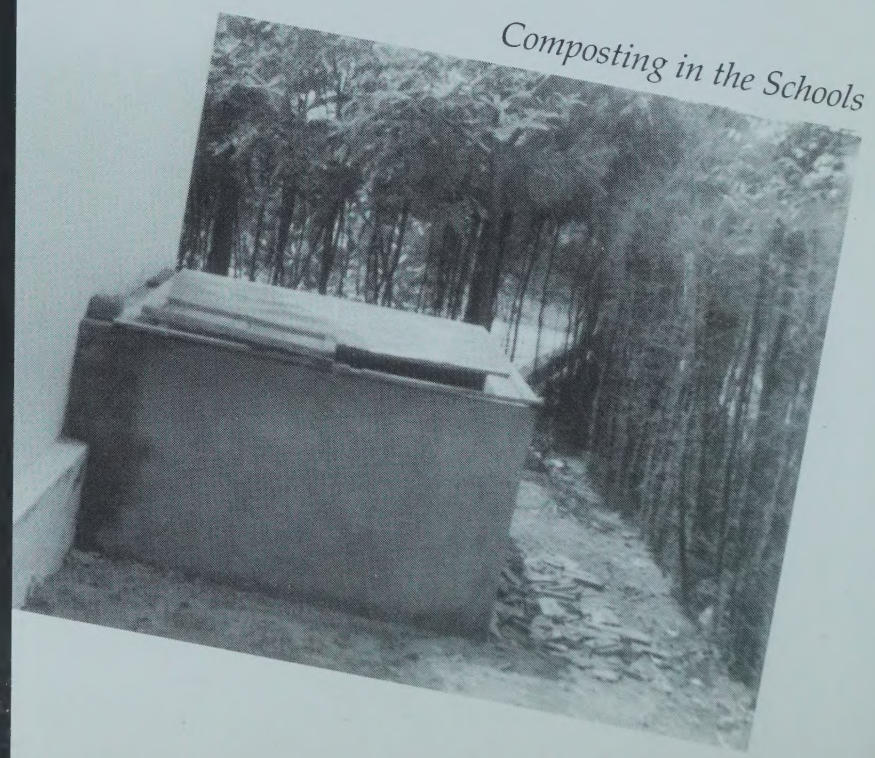
Leaving nothing to waste - making models out of discarded materials



...and to their school mates



Composting in the Schools



Rouse up Sirs ! Give your brains a Racking

To Find the remedy we're lacking....

– From the "Pied Piper of Hamelin" by Robert Browning

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Centre for Environment Education, Southern Regional Cell

Kamala Mansion, 143, Infantry Road

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Centre for Environment Education (CEE) is a national institution and a centre of excellence for environmental education supported by the Ministry of Environment and Forests, Government of India and affiliated to the Nehru Foundation for Development. The main objective of CEE is to create awareness among children, youth, decision makers and the general community. CEE develops innovative programmes and educational materials and field tests them for their validity and effectiveness. The aim is to provide models that can be easily understood and replicated to suit local conditions and help in reducing environmental degradation.

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Preface

The word 'Garbage' always conjures up images of dirt, filth and slovenliness. Something that people abhor and avoid looking at. And yet, we at CEE South wanted to change this image to one that would mean resource, greenery and conservation. It was difficult at first to get people to even talk about garbage or think about it as an issue to which they needed to find a solution. Slowly the mindset changed and communities began to participate in activities that addressed civic issues like garbage management, management of open spaces and parks and social issues like the role of the ragpickers in recycling waste material found in the garbage.

At first it was a herculean task to convince the people, the Municipal Corporation and other NGOs that garbage need not be transported miles to be disposed off in some unsightly dumpsite but could be managed within the colony in a scientific and clean manner. In the beginning and even now, constructing composting pits in a park belonging to the corporation invites comments and protests. However, we had to prove that 'garbage' need not necessarily mean that it has to be thrown out - outside the house, outside the colony, outside the city. By perseverence and diligence, it was shown that garbage could indeed become a resource. This was not only for the ragpickers who rummaged in it for useful material but for others too if only they would look at garbage, analyse its components and separate or segregate the worthwhile components from the useless material.

Tricycles were bought, ragpickers were given uniforms, protective gear and identity cards, committees were formed, composting pits were constructed and campaigns were held to promote the idea of segregation - separation at source and composting was carried out in parks, gardens and households. School children and college volunteers played a vital role in motivating citizens towards greater participation and in taking up responsibilities in their neighbourhoods. Finally, one colony after another started changing their ways and instead of throwing garbage like missiles out of their doors and windows, they began handing them in separate bins and bags to trained waste retrievers who had been ragpickers earlier, but were now organised and received a salary for their work from the community.

Bangalore is now one of the cities in India where organised garbage management is supported by the government through funds, land and other legal and infrastructural support. However, there is no place for complacency since people will always need to be motivated and educated and governments pressed into acion for providing better infrastructure and funds. Let us carry forward this movement and teach our children to be better managers of our resources and the earth.

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A Note to the Teacher

Dear Teacher,

I live in a city and although most people find my city beautiful, the scene that assaults my senses is that of the dirty streets and overflowing garbage bins with rotting organic waste. This is the case in most cities, smaller towns and villages as well.

This ever increasing quantity of garbage is not only believed to be due to an increase in the number of people generating the garbage, but also because we lack civic sense. We turn a blind eye towards managing the waste we create. In addition, with each passing day, we generate increasing amounts of garbage. Indeed, in today's world, we often discard items that in earlier times would have been repaired or saved for other uses. Infact, many modern products are designed for a relatively short lifespan followed by a speedy trip to the garbage bin. A city like Bangalore generates nearly two thousand tons of waste per day - nearly seven lakh tons a year ! Can you imagine the amount of garbage that would be generated in a year in other cities in India as well and extend it to the entire nation ?

How can all this waste be managed in an environmentally sound manner ?
This is a complex and often controversial issue. Dumping trash directly into lakes, rivers and seas causes water pollution. Air pollution can result from combustion and from decomposition gases surfacing from landfills. Direct contact with garbage can be dangerous to the public, especially to waste retrievers and rag pickers.

Why should we be bothered about the management of waste? For the simple reason that wrongly managed waste has a negative effect on our health. Rotting garbage breeds disease causing bacteria and vectors such as rodents, mosquitoes and flies which help in spreading diseases ! By managing wastes soundly, we will be reducing the risk of spreading diseases such as plague, dengue, leptospirosis, malaria, etc.

How then do we dispose our garbage ? Our disposal options are steadily being reduced. The so called open dump is now recognised as potentially unsafe. More than 70% of what we throw away is currently deposited in open dumps. More than one third of the nation's open dumps will be filled within the next few years. Locating sites for new landfills or dumps is getting more and more difficult as there is a tremendous demand for land for housing and other activities, both in urban as well as in rural areas.

The only real solution to this ever increasing problem seems to be in reducing the amount of garbage we generate. This involves the formation of new attitudes and habits about waste generation, management and disposal. Attitudes and habits, if inculcated at an early age, will stay with the child forever.

You , dear teachers hold the future generation in your hands. As you know, there are several ways of motivating children and channellising their enthusiasm towards more constructive ends. This booklet suggests various methods that may be employed to communicate concepts about waste management to children. However, each of these activities is a mere suggestion that may require alteration to suit the understanding of your students. These activities help you to lead the children from knowledge about garbage to understanding and then action. Do write and tell us about the changes you feel are necessary. Your feedback will give us an indication of the utility and educational value of this booklet.

Networking

All schools that are undertaking such action programmes are registered with CEE South and a network of these schools is being formed. Children may like to write to other children doing the same kind of projects in different parts of India to exchange ideas and information.

Enthuse children to write articles - stories, poems, reports of their activities, experiences and so on and send it to us at CEE South. We can together start a magazine "Action for Resource Conservation" in which children can see their articles published. The focus of all articles must be waste management and resource conservation.

Schools that register with us will be issued a certificate. The team consisting of a teacher and a group of children who give us regular feedback and contribute to the "Garbage to Gardens" network will also be given a certificate of resource conservation.

If you as a teacher, succeed in motivating your students to take up action programmes, please register your school's name with CEE South at the following address :

CEE South Solid Waste Management Group
Centre for Environment Education, Southern Regional Cell,
Kamala Mansion, 143, Infantry Road, Bangalore 560 001
Phone : 080 2869094, 2869907, 2862167
Fax : 080 2868209

Here's wishing you a happy journey from **Garbage to Gardens !**

Archana Dange.

How to use this Booklet

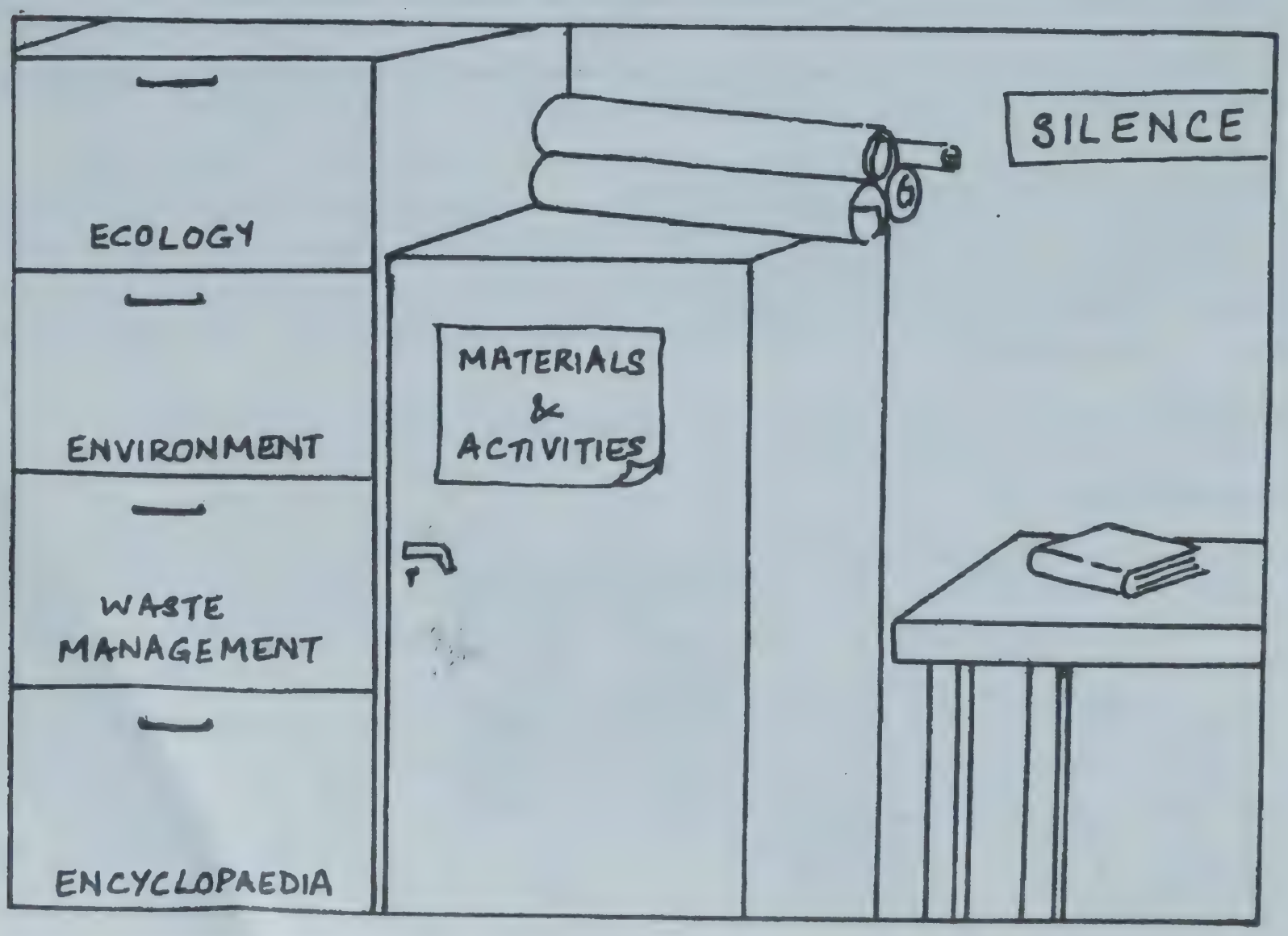
The activities suggested in this booklet may be taken up during the SUPW (Socially Useful and Productive Work) period or as part of language, science, math or social studies. Alternatively, interested students maybe formed into an eco-club and may be encouraged to take up the suggested activities as part of the activities of the club.

This booklet is divided into modules. One basic concept of Solid Waste Management is described in each module. Each module has :

1. Background information to help the teacher understand the concept
2. Few activities designed to aid the teacher to communicate the concept.
3. Questions, tables, suggested statements, figures and posters that can be used to help children carry out the activity.

Towards the end of the booklet, a few action programmes have been suggested, which sould be taken up by the children, in the class, school and neighbourhood with guidance from the teacher. The teacher could also involve parents by keeping them informed about all the activities undertaken in school.

The teacher is encouraged to try out his/her own modifications and alter the activity to suit the needs of the class or school.



Module 1 - What is Solid Waste ?

Background Facts :

Garbage is Solid Waste too!

Waste may be of three types - solid, liquid or gaseous, depending upon the state of matter. Non-gaseous, non-liquid wastes which result from various human activitites are called solid wastes. They are unwanted material disposed off by us from our homes, industries, shops, offices and hospitals. Since the problems of disposing them are quite different from those of disposing liquid or gaseous waste material, they need a specific type of management.

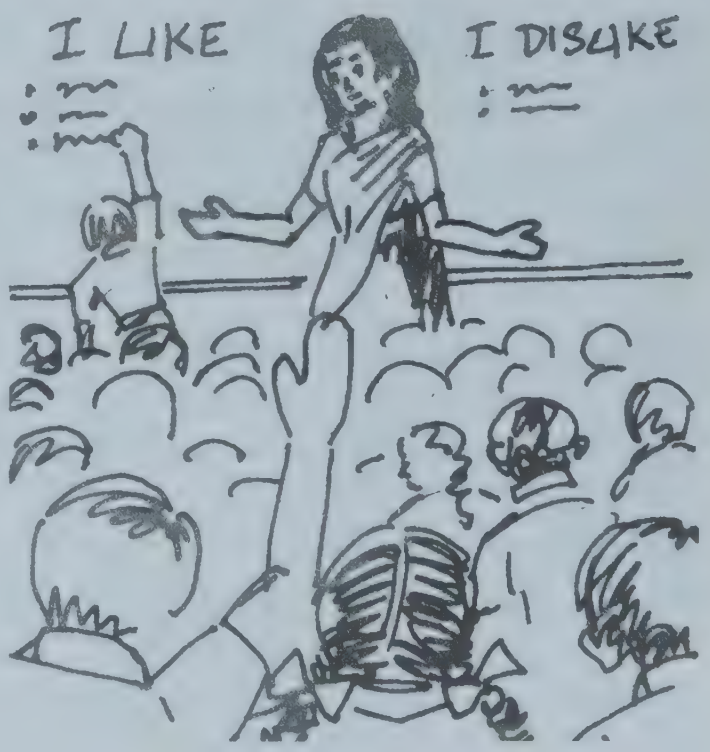
With industrialisation and increasing consumerism, not only has the quantity of garbage increased, but the nature of the garbage too has changed. Though rural wastes are still majorly bio-degradable, wastes from urban centres contain diverse types of material which include toxic and hazardous wastes such as containers of insecticides, acids, syringes, needles, etc.

Solid Waste Management

The designing of collection, storage, transportation and disposal of garbage and other solid wastes is called solid waste management.

Aim

To make children aware that solid waste generated in the community is mostly garbage thrown out of homes, colleges, schools and offices. Each person is part of that very community which generates the garbage.



Activity 1

Ask children to list out 5 things that they like about the area in which their school is located and five things that they do not like about the area in which their school is located. The same excercise could be done with reference to their homes.

Is one of the components in all the lists of the "do not like" section, garbage?

Attitude : "Ahhh ! That glorious stink of rotting garbage ! How often have you walked past that overspilling garbage bin, holding your nose or your breath ?"
Such statements could very well serve to introduce the topic of garbage to the class. Alternatively, ask each student to define garbage.

The dictionary defines garbage as offal, waste matter, refuse.

Activity 2 The Garbage Bin.

Ask each student or about ten students (in the case of a large class) to mime out their reactions to a garbage dump. Faces with screwed up noses and hands waving in front of their faces will not only enliven the class, but will also make them aware of their own reactions to the garbage bin.

Activity 3 What is garbage ?

Make children refer different dictionaries to find out the synonyms of the word "garbage". Maybe they could be encouraged to draw pictures of what each synonym reminds them of.

Activity 4 Take a guess !

Ask the class "what is garbage made up of ?" The probable answers would be : Kitchen waste, paper, tetrapaks, chocolate wrappers, broken glass, plastic bottles, old rags, plastic covers (torn), bandages, phenyl bottles, pesticide cans, batteries, rubber, syringes, needles, broken bulbs and tubelights, paint, chemicals, etc.

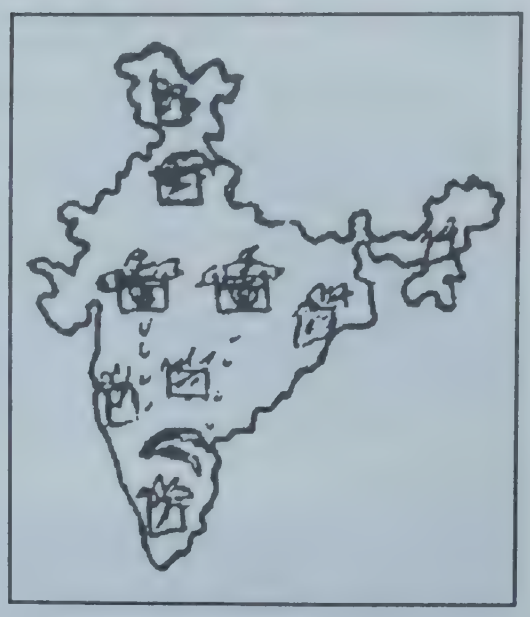
Of these, used bandages, band aids, syringes, needles, sanitary napkins and condoms can be collectively classified as "soiled" while batteries, broken tubelights, bulbs, paints, chemicals, expired medicines and pesticides can be classified as "toxic".

Kitchen and garden waste are best referred to as "wet" since they contain some moisture always and the others such as discarded paper, plastic, glass, metal, can be called "dry ".

So now, the children know four types of garbage.

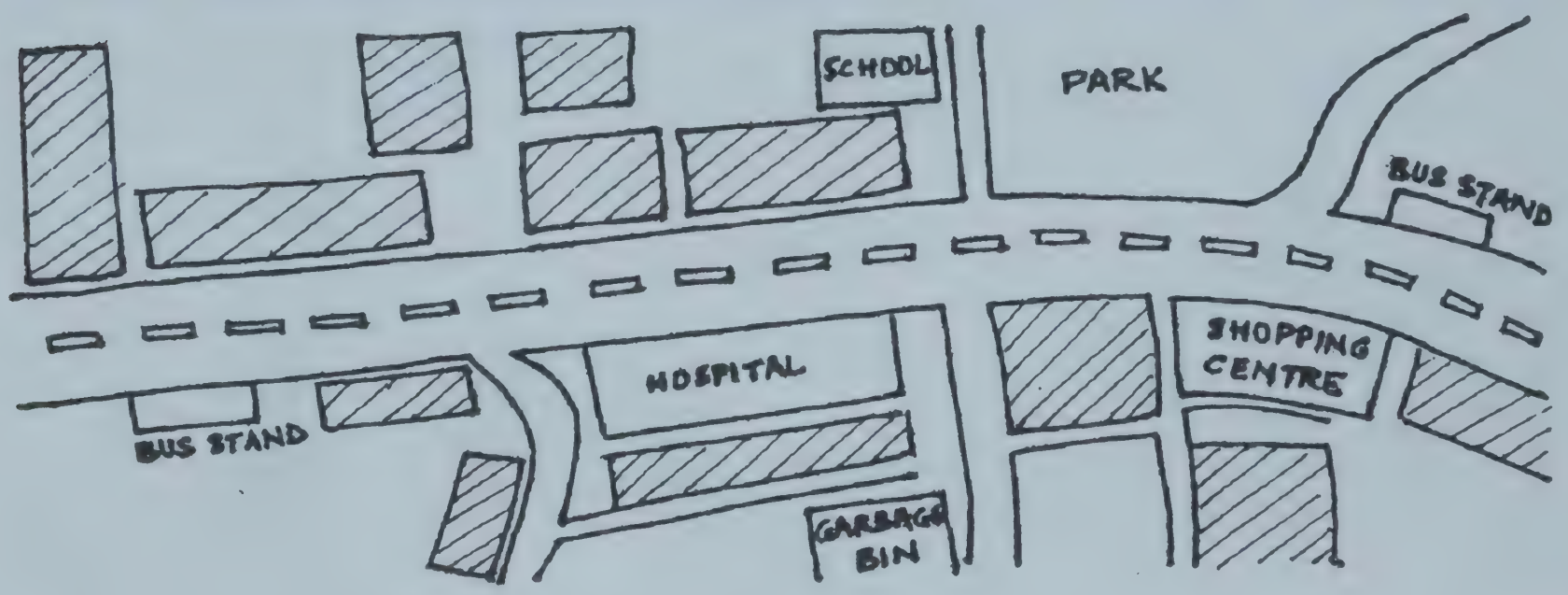
Extension : Take a Guess Again.

Ask the children "Which of these substances makes the garbage stink so much?" Do the children realise that garbage stinks because it contains a lot of organic matter? In fact, 70% of Indian Garbage is organic matter. In bins, it is left to rot and is not cleared for days. In this process of rotting or decomposing, the bacteria act on it. This releases methane and other gases (called decomposition gases) which is the main reason for the bad smell.



Activity 5 Where I live....

Make a map showing approximately the position of the garbage bin near your house, school and the houses, shops and schools which contribute to that bin.



Activity 6 ....where does so much garbage come from....

Let us observe a garbage bin.

Select a garbage bin/bins close to your school. Ask the children to observe for a period of 12 hours (split over 12 days of one hour each) as to who dumps garbage in the garbage bin. Make a list of the houses, stores or institutions which contribute to the garbage bin. Also notice who comes to throw the garbage and observe whether the person throws the garbage inside the bin or outside.

Ask the children to note their observations in the worksheet. (Table A-1)

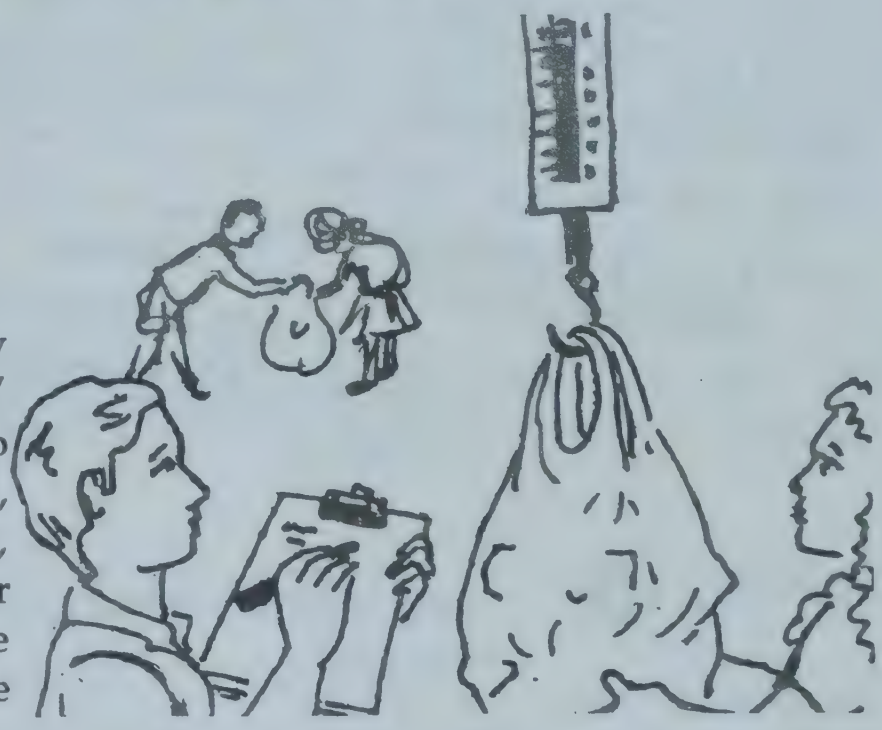
In the student column, the student must enter her/his name. The time and the date when the student collected the information, eg. 7.30 a.m. to 8.30 a.m., may be entered in the time and date coloumns. The 'source' column should indicate whether the garbage is being thrown out of homes, clinics, schools, shops, colleges, offices, any other sources (specify). In the 'who throws' column, the person who throws the garbage, eg. servant, gardener, peon, watchman, person of the house needs to be recorded. In the 'throws' column, whether the person throws it inside the bin or outside it should be recorded in the table as shown below.

Table A-1 **Worksheet**

Student	Date	Time	Source	Who Throws	Throws	
					Inside	Outside
Shruti	15.3.98	7.30 a.m.	House	Servant	X	
	15.3.98	7.40 a.m.	House	Servant		X
	15.3.98	7.45 a.m.	Shop	Boy		X
	15.3.98	8.00 a.m.	Hotel	Man	X	

How many persons throw the waste outside the bin as compared to those who throw inside it ? Help the children understand that this is how the road gets dirtied.

Activity 7



Materials Required:
Used plastic bins or baskets
Paper or plastic covers
A Spring Balance

For one day, ask each child not to throw anything into the dustbin. Instead, ask her/him to collect whatever she/he has to throw-paper, vegetables, fruit-peels, leftover food, plastics, packaging material, sweet wrappers, etc. in a used plastic or paper bag. Ask her or him to weigh the amount of waste collected at the end of the day.

This will be the amount of waste generated per child per day. To get an idea of the average weight of garbage generated by a child, the children may be asked to total the weights recorded by each student in the class and divide it by the number of students in the class. Ask the children to relate these amounts to the total quantity of garbage generated by a family per day for a year.

Note :
For weighing the garbage collected, ask the children to weigh an empty bag, bucket or bin using the spring balance, then take the weight of the same after filling it with the garbage they generated. The difference in weight gives the actual weight of the garbage. Alternatively, the volume of a normal plastic bucket is 10 litres. This can be used as a standard measure. If a spring balance is not available, students can be asked to put the waste in a thin plastic cover, tie it up and request a shopkeeper to allow them to weigh it on his/her weighing scale.

....and where does it go...

Discuss : Who removes the garbage from the garbage bin?
Probable Answers : Men and women who come with the garbage lorry, City/municipal Corporation workers with wheel barrows and others.
Ask the children if they have seen dogs, cats, insects, birds in and around the garbage bin? Anybody else? Have they observed some others who take from the garbage bin only that garbage which they want? What about rag pickers? Who are these people? What do they pick from the Garbage Bin and why? Are they specifically looking for something? In this you can introduce the role of ragpickers to the children.

Activity 8

To encourage children to find out who removes the garbage from the garbage bin, ask them to make a table as given below and enter the relevant information :

Table A-2 Who Removes the Garbage from the Garbage Bin ?

S. No. To be Observed	Findings
1. How many garbage bins are there? on your street in your colony in your area 2. Are they sufficient? 3. Do Corporation Workers come to your area? everyday every alternate day once a week other (specify) 4. How many Corporation Workers come at one time? No. of Men No. of Women 5. How many Ragpickers come to the bin ? No. of Ragpickers 6. What implements do they use for cleaning the bin and putting the collected waste in the lorry or truck? 7. What vehicles are used to transport the garbage? 8. Where do these vehicles dump the garbage ?	

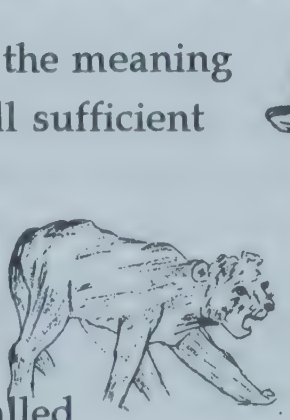
Activity 9 Guest Lecture

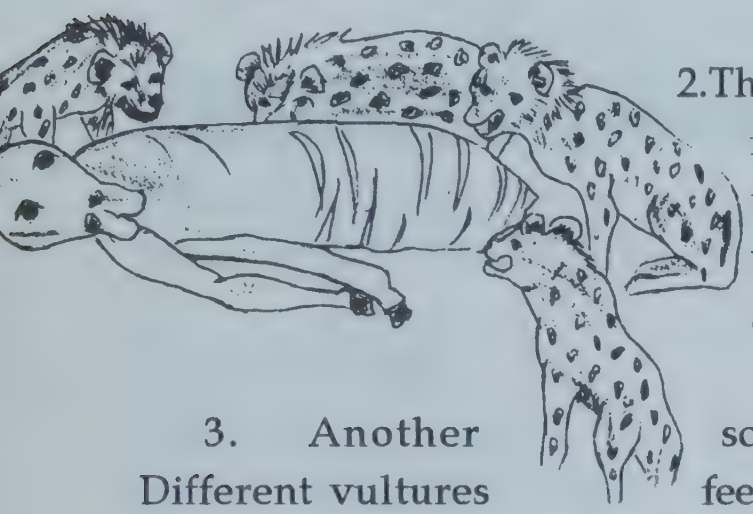
Arrange for a lecture by the local area corporator, Chairman of the Health Committee or by the Commissioner of the Corporation to help the children understand how garbage is cleared in the town/city. What are the problems faced by the corporation in clearing the garbage? Encourage the children to ask questions and later a discussion can be held in the class as to what the children learnt from the lecture. Do they feel what the Municipal Corporation was doing was sufficient to clean the area/town/city? what are the problems the Corporation faces? How can we help? These questions can be asked of the speaker and then reinforced in the discussion. Give two or more children the responsibility of taking notes from the speakers' talk. This can be compiled and sent to CEE South (address-page 2) for the "Garbage to Gardens" Network Newsletter.

CHART 1.

Learning from Nature – Want Not, Waste Not

1. Lionesses, like all predators, do not know the meaning of overkill. They hunt out of hunger and kill sufficient prey to feed their families. Once their appetities have been satisfied, the remains of their meal (carcass) is not wasted. Other animals such as hyenas follow the lionesses and arrive for their meal. These animals are called scavengers.

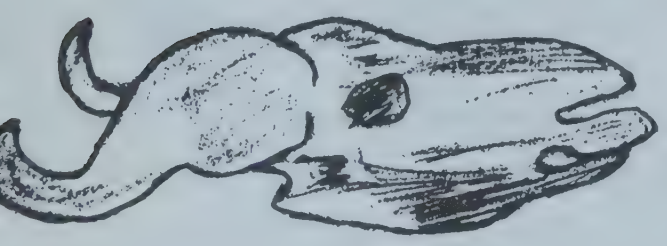




2.The hyena is a scavenging animal which prefers an easy meal of the leftovers of another's kill rather than one that involves a chase. The animal is a perfectly designed waste disposal unit of the natural world. It can devour any part of a carcass, except the horns and teeth.

3. Another scavenger is the vulture. Different vultures feed on different parts of the carcass. Between them, the birds eat most of it, from the tough skin to soft muscles and even the marrow from bones. Within hours, the bones are laid bare.

4. Once the larger animals have taken all they can from the carcass, it is the turn of the carrion flies and beetles to feed on the last of the debris. These decomposers feed on animal wastes and dead plants and animals, eventually breaking these materials down into simple raw material which can be reused to support plant growth.



5. Bacteria and Fungi are the only decomposers that can complete the chemical breakdown of complex plants and animals into simple raw materials like oxygen, carbon, nitrogen and phosphates. The entire process of decomposition may take many years. But without decomposers to break down waste and recycle the essential raw materials, the earth would be piled high with natural litter and all life would die.

Source : Waste : 3.83 in a poster series produced by World Wide Fund for Nature UK Wayside Park, Godalming Surrey GU7 1xr United Kingdom.

Background Facts :

Table B-1 Solid Wastes produced by Human Activities

S. No.	Human Activities	Wastes Generated
1.	Agricultural	Plant Remains, Processing Wastes Animal Wastes
2.	Domestic	Paper, plastic, glass, metal, rags, food, fruits, vegetable peels, garden litter, packaging, batteries, chemicals, condoms, sanitary napkin, and some proportion of biomedical wastes.
3.	Municipal	Sweepings from streets, schools, colleges, offices, factories, hospitals, clinics, petrol bunks, shops, etc.
4.	Industrial	Wastes generated from mining operations, manufacturing, construction work, thermal stations, chemical industries, paper making units, textile mills, cement factories, factories manufacturing engineering goods, etc.
5.	Health care	Health care establishments generate wastes like needles, syringes and other potentially infectious wastes

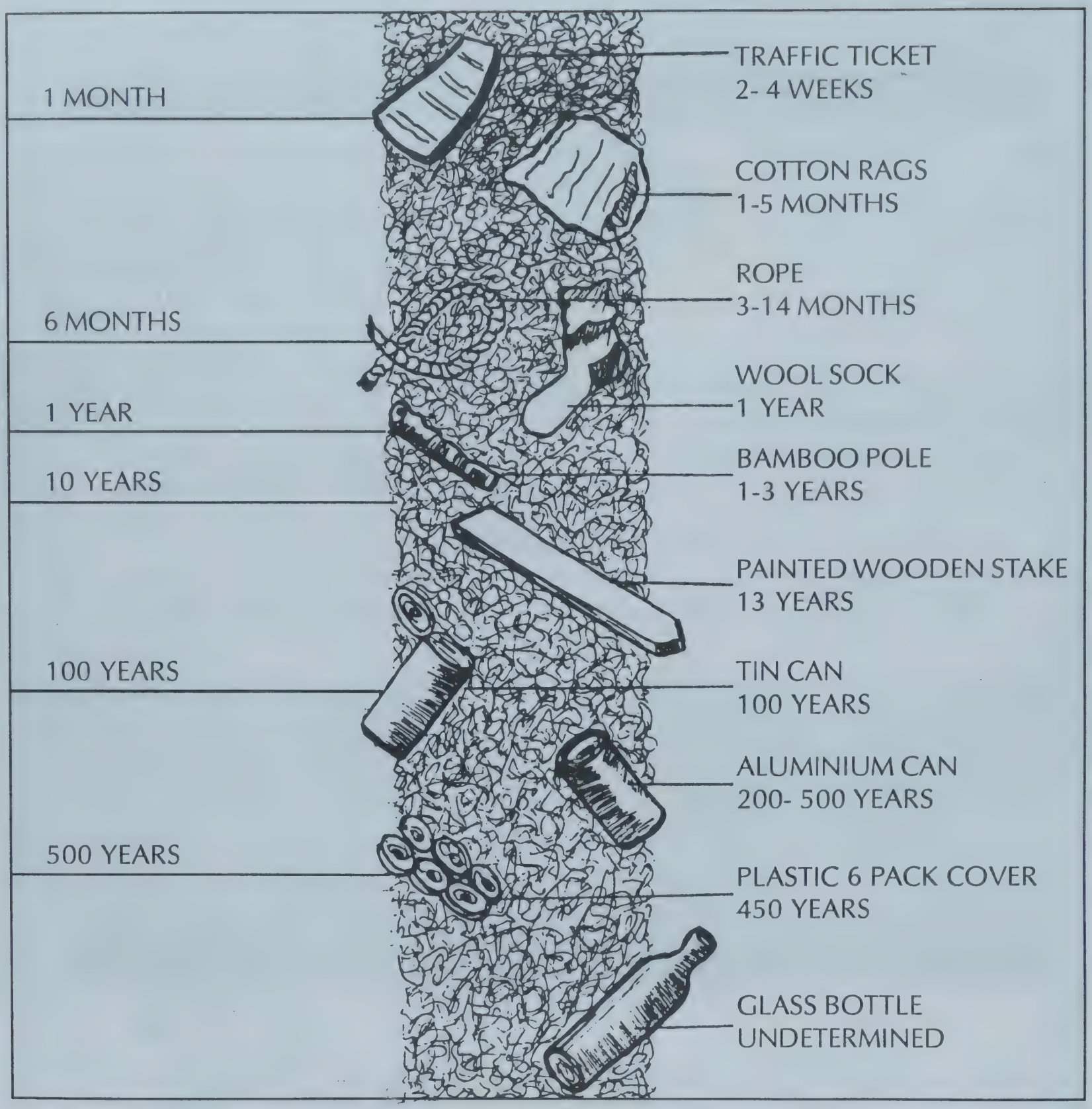
About 27 % of India's population lives in urban areas and generates approximately 15 millon tons of solid waste every year. The quantity of waste generated is lower in developing countries. However, increasing quantity of waste reflects the wastefulness and growing consumerism in a society.

Table B-2 Some Typical Refuse Generation Rates

S. No.	Country	Kg/person/day
1.	India	0.30
2.	Sri Lanka	0.40
3.	Malaysia	0.70
4.	Singapore	0.85
5.	European Nations	1.00
6.	America	1.25

CHART 2

Enduring Litter



Reprinted from The Waste Anthology : A Teacher's Guide of Environmental Activities K-12 produced by California Department of Toxic Substances Control, Public Education Unit. The No Waste Anthology is a compilation of interdisciplinay, action-oriented, cooperative problem solving activities focussing on pollution prevention. Produced in 1991, the publication is divided into three sections :
Natural Resources and Polllution, Solid Waste and Hazardous Waste.

Activity 10

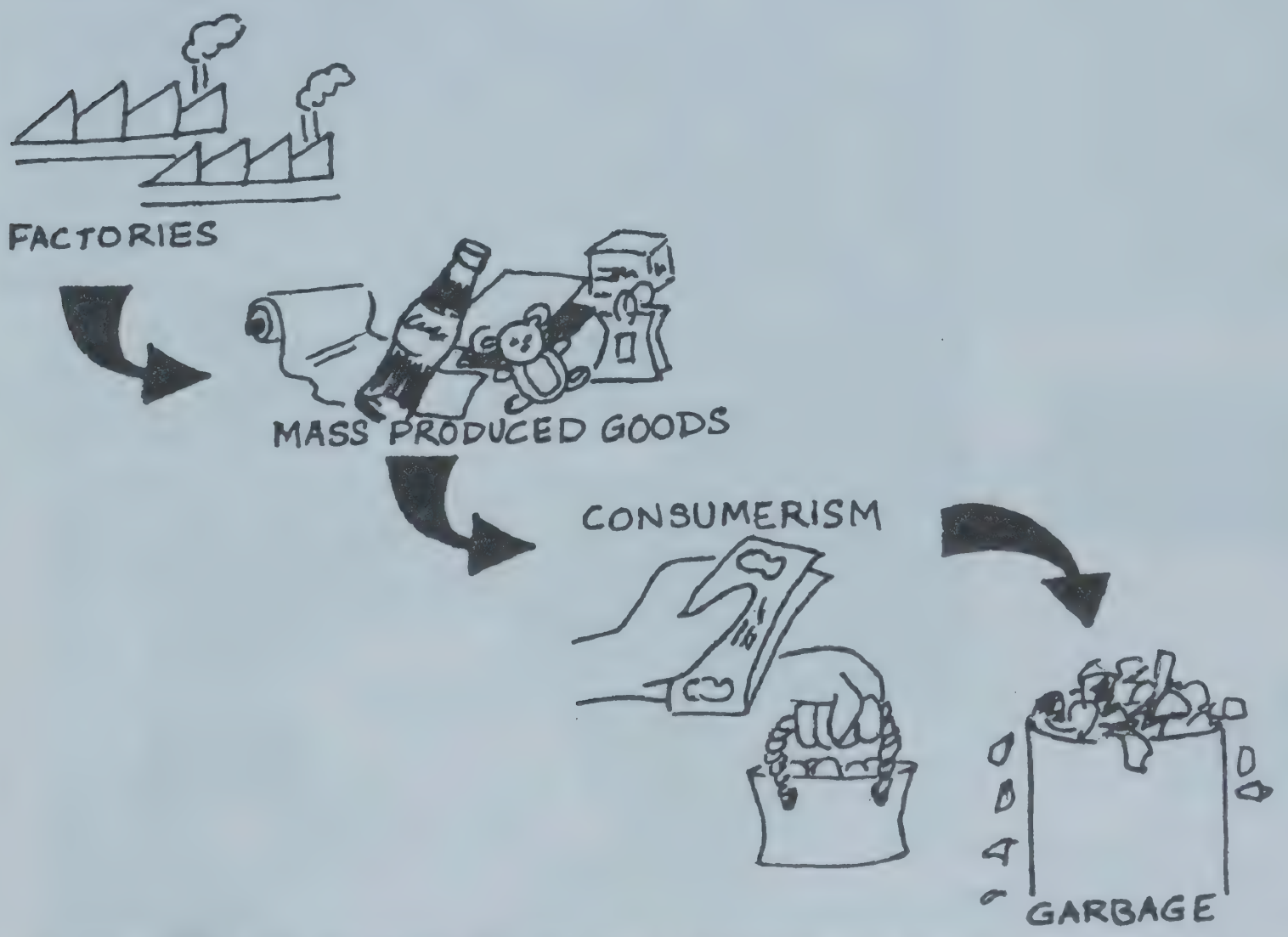
Call on volunteers in the class to list on the board, a few disposable items they have used. Beside each item listed, ask them to list the more durable alternative. For example

Disposable	Durable
Plastic Cups	Steel or Glass tumblers
Paper plates	Steel or glass plates

Ask students to give specific reasons as to why they choose certain disposable items over more durable, long lasting products. Today, it appears that fancy tins and packaging sell the product more than the utility of the product itself. Plastic containers, use and throw ball pens are fast replacing refills; disposable syringes, disposable razors, are replacing the resterilisable metal and glass ones.

Activity 11

This activity is to bring home the fact that modern consumeristic trends have contributed to increased wastes.



Do you think that people who lived 25-30 years ago had as many things as we have, that could be thrown out after one use?

Let the students know that people in the past often did not have the choice of buying disposable products. There were fewer products available and less variety. People bought what they could find and tried to make them last for as long as possible. Advances in

Industry and Technology have made certain products cheaper to mass produce and the result is that it is sometimes more expensive to repair an old product than buy a new one.

You may ask the students if they have encountered such a situation.
To answer the question, ask students to investigate the way people lived 25 to 30 years ago. They could ask their grandparents and other older members in their homes or locality. Based on their findings, have students form groups to re-create scenarios of the periods in the community's history. Students may want to consider food habits, eating habits, clothing, energy use, cleaning, recreation and waste disposal techniques.

In a follow-up discussion, encourage students to discuss what choices they can make today, to reduce the use of disposable products and extend the life of things that they use.

Unnecessary packaging is a waste of raw materials and energy
Glass and metal are both reusable, and can be recycled
AVAILABLE NOW
NEW EXTRA LARGE ECONOMY PACK
WASHING POWDER
Paper, jute and wood are reusable, recyclable and biodegradable
RASHMI
Cola

Most goods are packaged today even if they do not need any packaging.

Module 3 - Garbage on our Street

Background Facts :

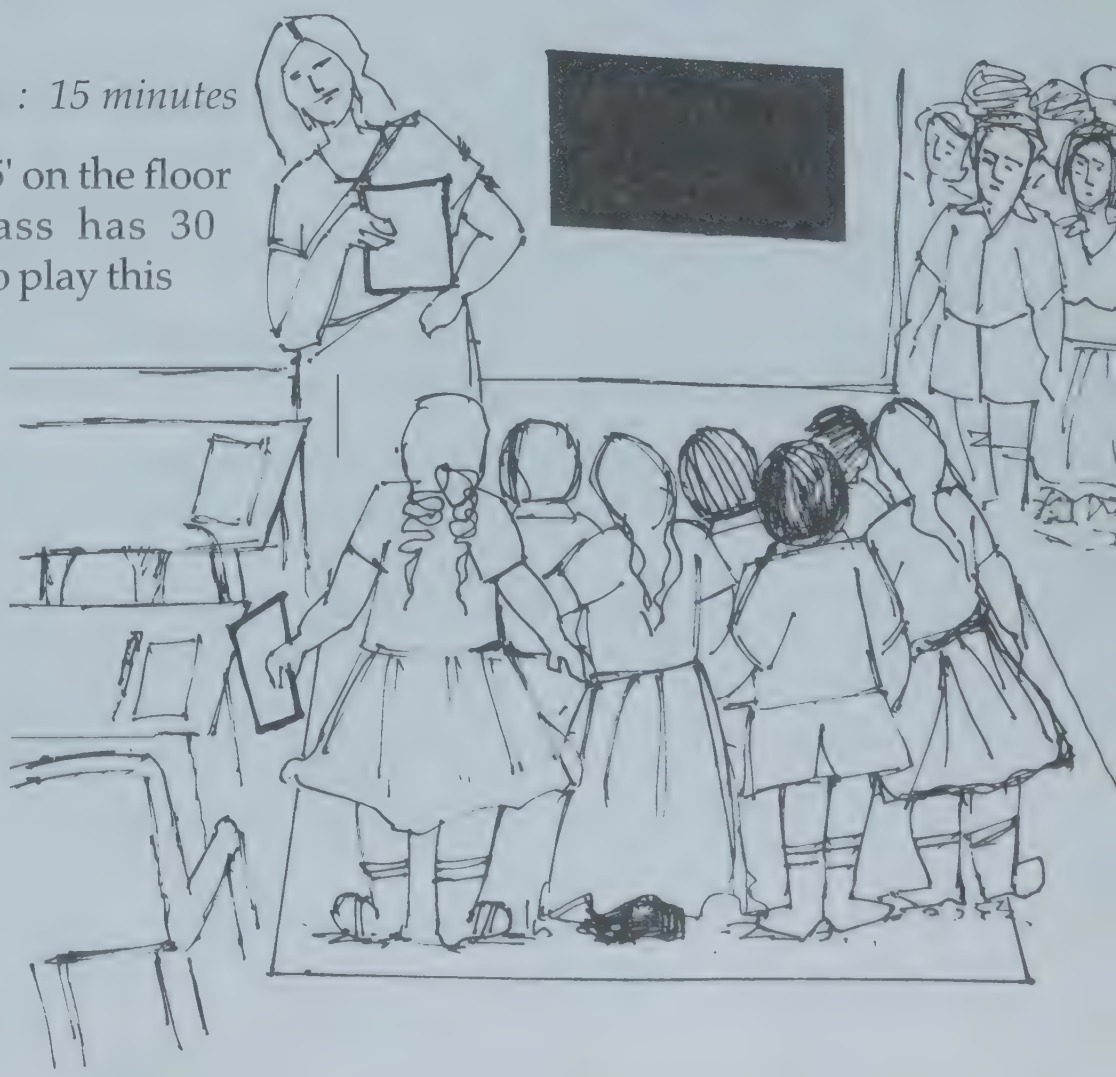
Each day, there are more people pouring into the city. People come to the city from the surrounding smaller towns or villages in search of employment and better living facilities. But our cities are rarely equipped to support this ever increasing population. Although the municipality or corporation may be working hard to clean the city or town, it just does not seem enough. This is because each person generates some amount of waste. More the number of people, more the amount of wastes.We have seen that all of us generate some amount of waste; that as a family, we generate wastes which we throw into the waste baskets. These waste baskets are later emptied in the common bin provided by the municipality or corporation. The amount of garbage in the common bin is thus the amount of garbage generated on one street by many households. The introduction of apartments or flats for urban housing has further complicated the problem of waste generation and collection; in the space of one large house, there are forty or more houses. The waste that is generated will naturally be that much more. Yet the space provided for waste collection is the same. That is why we need to be aware about what we throw and where we throw it. Each individual has a responsibility of keeping the road clean. Many areas have now formed neighbourhood associations which try to maintain a standard of cleanliness in the area and solve other civic problems.

Activity 12 The Square *Time : 15 minutes*

1. Draw a square approximately 5'X5' on the floor with chalk. Suppose your class has 30 children, ask about 15 volunteers to play this game. Within the square drawn, place about 5 sheets of waste paper to represent Resources.

2. Ask one child to step inside the square, pick up any number of sheets and mark them with a crayon as food, water, shelter, air or any other material that she/he may wish to have.

3. Next ask the child to invite another student to share the resources in the square.



The second student will either take the resources left unpicked by the first, or ask the first child to share some of her/his resources with her/him.
Note : Once a child invites another into the square, she/he must share her/his resources with the person invited. Resources are shared by tearing into half, the paper representing the resource. Also each time a child invites another into the square, she/he is given 2 points.

4. After each of them decides which resources belong to whom, each must try to gain maximum points by calling one by one the maximum number of people to share the resources.

   Note : The child with the largest resource will be given the first chance to call a person into the square. Also, once you invite a person into the square, you have to share whatever resource you have with her/him.

5. Ask the rest of the class to observe the reactions as the square becomes crowded. The obvious reactions - pushing, restlessness and general agressive behaviour. You can now talk about the pressures of crowding.

6. Ask all students to drop all the pieces of resources (by now, the pieces of paper will be really small bits due to the sharing of resources) into the square and go back to their places in the class. Ask them to observe the square. What they will see is solid waste pollution which results from haphazard division of resources in a community. The children will now be able to understand that with an increase in the number of people to share the limited resources and space, solid waste is generated.

Activity 13 Inside Outside

Ask the children how garbage is collected in each of their homes. Ask them the following questions. Each child is also asked to collect information by posing these questions to at least 10 houses in their locality including their own.

1. How many garbage bins do you have in the house?
2. Are there any rules for throwing garbage in your house? e.g do you have the habit of throwing certain types of garbage in certain bins only?
3. How is the garbage disposed ? Is it thrown outside the house? in the garden? Or is it taken to the Corporation Bin at the end of the road?
4. Who clears the garbage that is thrown from your house? Does she/he collect the garbage from each bin separately?
5. Once cleared by the Corporation, where is the garbage dumped?
6. How many houses are there on your street?
7. How many people live in each house?

8. From Activity 7, you have learnt the average weight of waste produced per person per day. Can you approximate the amount of waste generated on your street per day?

   e.g. If the population of your street or block of apartments = **p**
   and the amount of garbage generated per person per day = **0.3 Kg.,**
   the amount of garbage generated by your street would be = **p x 0.3 Kg.**

9. Are there any civic forums or citizens' associations which monitor the clearing of garbage in your area? Are you a member ? Has anyone from your area written to the authorities about civic problems of the area?

The information collected could be tabulated as follows :

Table A-3 **Community Profile**

1. Name of the area/locality/road :
2. Number of houses on the street :
3. Population of the street :
4. Kgs of garbage produced per family per day :
5. Kgs of garbage dumped on the street :
6. Number of corporation bins on the street :
7. Person clearing the garbage bins :
8. Frequency of clearance of the garbage bin :
9. One civic forum or organisation which monitors the garbage clearance of your area :
10. Number of people on your street or block who are members of such a forum :

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Activity 14

Living in a city or town means we have to share a number of facilities with others who live in our city. Ask the children to list some of these facilities on the board. Beside each facility, they can list how these facilities are used collectively and list how each could do their bit to keep the facilities in good condition.
e.g.

Facilities	Uses	Responsibility
Childrens' Park	Playing games, picnic, walking	Should not throw chocolate wrappings or any waste in the park. Should find a dustbin to throw waste. Should not pluck flowers.
Road	Commuting from and to school.	Should not litter the road. Should not spit on the road, should not paint on the road with chalk. Should not pitch cricket wickets on the road. Should not play on the road.

Other common facilities that the children may like to list down could be streets, roads, buses, gardens, lakes, rivers, etc.

Module 4 - Wasted Resources

Background Facts :

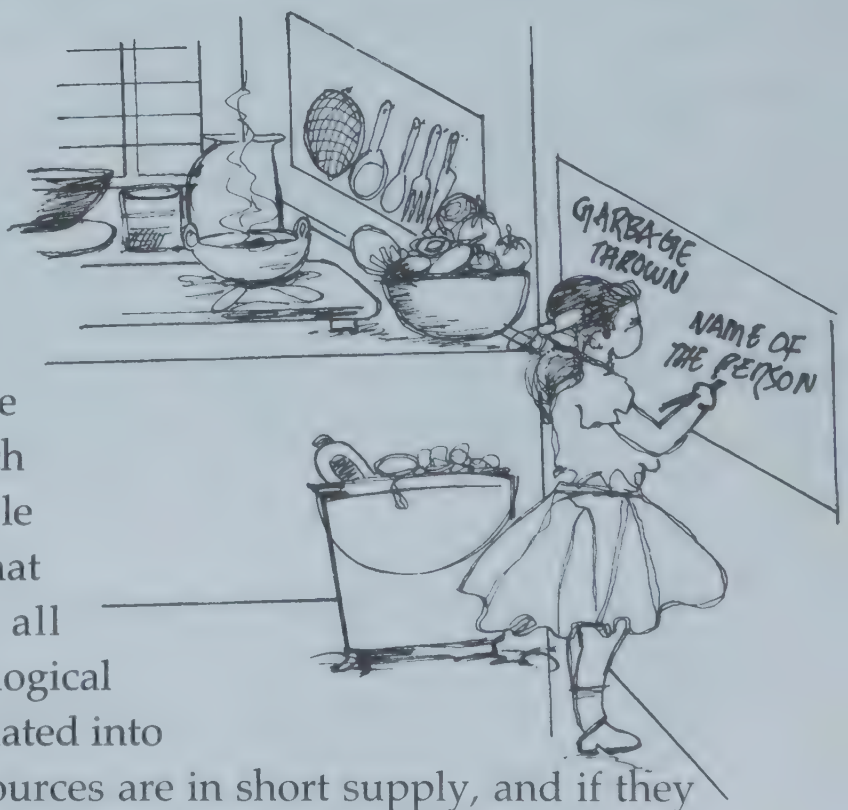
All of us generate waste as a consequence of our daily activities. Everyday, we use many articles which sooner or later are considered useless and are discarded by us. But do we realise that everything around us, natural or man made primarily comes from the Earth.

The Earth's resources may be said to be of two main types - renewable and non-renewable resources. Resources such as plants, animals, air, water and soil are considered to be renewable because the elements and components which make up these resources are easily disintegrated and assimilated by nature over a short period of time. Whereas, the time taken for disintegration and assimilation of compounds of non-renewable resources extends over millions of years. Examples of non renewable resources are minerals and fossil fuels.

Thus everything around us is nature's precious gift and we have to learn how to use it properly, without wasting any of it. We have not inherited the earth from our ancestors, we have borrowed it from our children. We must desist from using up and wasting Earth's Resources, or else, the future generations will have to bear the brunt of our Greed.

Activity 15

For one day, ask the children to pin up a blank sheet of paper near each garbage bin in their homes so as to enable any one who throws any thing into the bin to record what is being thown.



Making use of the diagram "Resource Tree", have students identify the raw material used to make each of these items and decide whether they are renewable or non-renewable. In the discussion, point out that Aluminium, tin, steel and petroleum are all non-renewable because they are the result of geological processes which take millions of years to be assimilated into the earth's crust and renewed. Non-renewable resources are in short supply, and if they are used up once, they are gone forever, unless they are reused or recycled. Paper and cardboard come from a renewable resource - wood (tree), but wood is being used at a

faster rate than it can be regrown. At the conclusion of the discussion, students should be able to categorise solid wastes as coming either from renewable or non-renewable resources.

Activity 16

Ask the children if they can think of any products or items they use that does not come from the earth. The students may name some things, but on close examination, it will be found that these things will also come from the earth.
e.g.

- Organic wastes such as food scraps. (renewable)
- Glass bottles from sand, soda ash and limestone. (non-renewable, but in plentiful supply)
- Plastic Containers or bags from petroleum. (non-renewable)
- Tin plated steel cans from iron and tin. (non-renewable)

When products are discarded, resources are wasted.

Extension

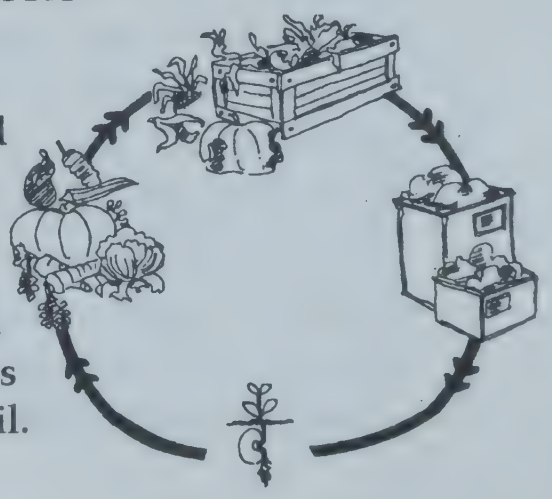
Discuss ways to reduce the wastage of renewable and non-renewable resources.

The following set of questions and answers may be used to conduct a participatory discussion or in a skit or debate.

What is waste ?
When something is unwanted or no longer serves a purpose, it is generally thought of as waste. Solid waste is any unwanted material, solid or semi-solid, that is "thrown away" by individuals, industries or communities. What is thought of as waste varies from person to person. One person's waste rags, may be another person's recyclable cloth. What is thought of as waste may vary over time. The once wasted products of pulp and paper industry are now a source of fuel and chemical feed for animals.

Do we all create waste?
Every living being uses energy to process raw material and in the process, creates waste. Nature's wastes - old leaves, animal droppings, etc. seem to disappear. But nature recycles its nutrients. Earthworms, millipedes and other soil creatures obtain food by digesting dead plants and animals. Microorganisms - bacteria, fungi and other decomposers continue the process by breaking down the complex structures of dead plants and animals into simpler components such as carbon, nitrogen, phosphorus and potassium, which enrich the soil. Absorbed by the plants, these nutirents are essential for growth.

Can't waste generated by people be recycled in the same natural way?
Some of it can, certainly. Organic materials, such as vegetable peels, fruit scraps, egg shell, ash, saw dust, etc. can be composted. Microorganisms feed on these materials and churn out a dark, rich, crumbling substance called humus. When added to the soil, this humus is a natural fertiliser and increases water retention in the soil.



So why is the waste generated by us a problem?
It is true that much of the waste we generate is organic or bio-degradable and so is able to decompose with the help of microorganisms. But people accumulate waste far more rapidly than it can be decomposed. The overloading of nature's "waste decomposing machinery" inevitably leads to water, air and soil pollution. In addition, there are a number of manufactured products that are not biodegradable. Some of these degrade through chemical breakdown - nails for example, rust.
But other products are neither chemically nor biologically degradable. Neither time nor nature's elements will ever make this garbage disappear in the near future. Some synthetic materials such as plastics, take so long to decompose (due to their molecular structure) that they are considered non-biodegradable.

Is the garbage problem getting worse?
Yes. The problem of waste grows with each new person on the planet. More people make more waste, and, as cities mushroom, the waste builds up. But it is not that simple. As people earn more, they consume more and they become more wasteful of the earth's resources. Too often, items are discarded when they could have been repaired or saved for other uses. Products are often designed for a relatively short life, to be cast aside for something new and more popular. Convenience goods are packaged in containers that are thrown away instead of being reused.

Technology can also contribute to today's waste crisis. Before modern technology, the chore of harvesting the earth's natural resources, like minerals and petroleum, was extremely difficult. Today, with the help of complex machinery, resources are exploited relatively easily. This often leads people to think that it is an easy task to simply find and harvest more resources. Sometimes, through ignorance, but often through a desire to make quick profits, forests are cleared, minerals are mined and energy sources are used up with little thought given to what will happen when the ores, energy sources and soils are exhausted.

What can we do about waste?
Our disposal options are steadily being reduced. Open dumps, often the only waste disposal method available have their share of problems and in some countries are being phased out.

What are open dumps and what is wrong with them?
An open dump is an uncovered piece of land used for depositing municipal solid waste. The garbage is not segregated or covered. Hence the dump smells and becomes the breeding ground for flies and rats. Domestic animals feeding at a dumpsite and people scavenging from dumps can contract diseases and spread them. When it rains, water running off a dump can carry pieces of garbage plus harmful chemicals and germs and can contaminate land and water nearby. Lined landfills are considered a better alternative to the unsafe and unsightly open dumps.

How is a landfill different from an open dump?
A landfill is often confused with an open dump. In both operations, rubbish is brought to a location and deposited. But that is where the similarity ends. A landfill is generally an engineered pit in the ground provided with liners which do not allow any leachates from the garbage from polluting the soil or the underground water. Large earth moving equipment run over the garbage and pack it down. At the end of the day, the compacted garbage is covered with a layer of soil. Each day's garbage becomes a cell. The cell is surrounded by mud on all sides. When the landfill is full, a thick layer of mud is put over the entire area and the site can be developed in to parking lots etc., but one cannot build heavy structures on the landfill area as it gives away to the weight of the structure. Since garbage is always covered in a landfill, few flies and rats can breed on it.

Do Landfills present any problems?
Yes. Several Problems with landfills have been discovered. For example, many landfills, especially those that have been built on wetlands, gravel pits and other areas with porus soils, experience problems with leaching. Water seeping through the landfill mixes with buried wastes such as battery acids, pesticides and other hazardous material. The liquid wastes, called leachate, can leak through the soil and into the surface water and ground water. Fears about leachate contaminating water supplies have led several countries to limit landfilling to sanitary landfill sites.

What are sanitary landfills and how can they help solve the leachate problem?
Sanitary landfill sites are lined with impermeable materials such as clay or plastic and built over impermeable soil to contain leachate. Lined landfills are very costly to construct. Some people claim that even liners and leachate collection systems are not permanent solutions to the leachate problem since tests have shown that plastic liners develop leaks when exposed to chemicals including solvents and acid.

Do Landfills present any other problem?
Yes. The rate of decompostition is extremely variable. It can be very slow due to compaction and limited oxygen supply. Garbologists - people who study garbage, are discovering that many of the biodegradable materials that we have assumed would decompose in a landfill, do not. They have uncovered 50 year old carrots, newspaper and other "biodegradable" items that are still intact. Methane build-up is another danger.

What is methane?
Methane is a gas. It is produced during anaerobic decomposition, which occurs when little or no oxygen is present. This gas burns quickly, and, if uncontrolled, can be dangerous. Methane contributes to the greenhouse effect. In some landfills, methane gas is being tapped and sold as fuel.

So landfills are not the answer to waste disposal management?
Not really. Some experts believe that many of the problems of landfills can be avoided or controlled with proper siting, design and operation of disposal facilities. But this could be costly. Also, many open dumpsites are filling up, and in many areas safe sites for new landfills are getting tougher to find.

Is there no single, simple solution to community's solid waste management problem?
It is very unlikely. To effectively reduce solid waste management problems, communities need to consider an Integrated Management Technique for management of garbage.

What does "Integrated Management Technique" mean?
It refers to the complementary use of waste management practises to safely and effectively handle municipal solid waste with the least harmful impacts on health and the environment.

The hierarchy consists of the following, listed in order of priority :

The Three R's

Reduction at source (avoiding the creation of waste in the first place)

Reuse of products directly (use goods and packaging more than once)

Recycling (convert waste into re-usable materials such as compost)

Disinfecting infectious wastes by using simple disinfectants or by autoclaving before disposing.
Incineration of infectious material
Landfilling of infective and toxic material (deep burial, but without introducing bacteria or toxins into ground water systems)

The United Nations' Environmental Programme (UNEP) endorses this hierarchy.

Have countries adopted this hierarchy?
In theory, Governments advocate reduction, then reuse and recycling with landfills as a last resort, but what happens in practise is usually reverse. Most governments focus on managing wastes rather than on reducing the wastes generated.

What is reduction at source?
Actually, source reduction isn't about managing waste at all. It's about managing natural resources more carefully in the first place so that the amount and the toxicity of the waste we generate is reduced.

What kind of actions can we take to reduce waste?
Manufacturers may contribute to source reduction by designing and making products that contain fewer toxics and less packaging. As consumers, we can buy more durable and non-disposable goods; products that can have more than one "life" and products with less packaging and fewer toxic components. We can try to buy food in bulk and store it in glass jars. One of the best ways to lessen our waste disposal problems is to reuse many of the things we habitually throw out.

CHART 3

Treating the Symptom, not the Disease.

The waste disposal crisis is but a symptom of a global economy built upon the inefficient use of the raw materials and energy.

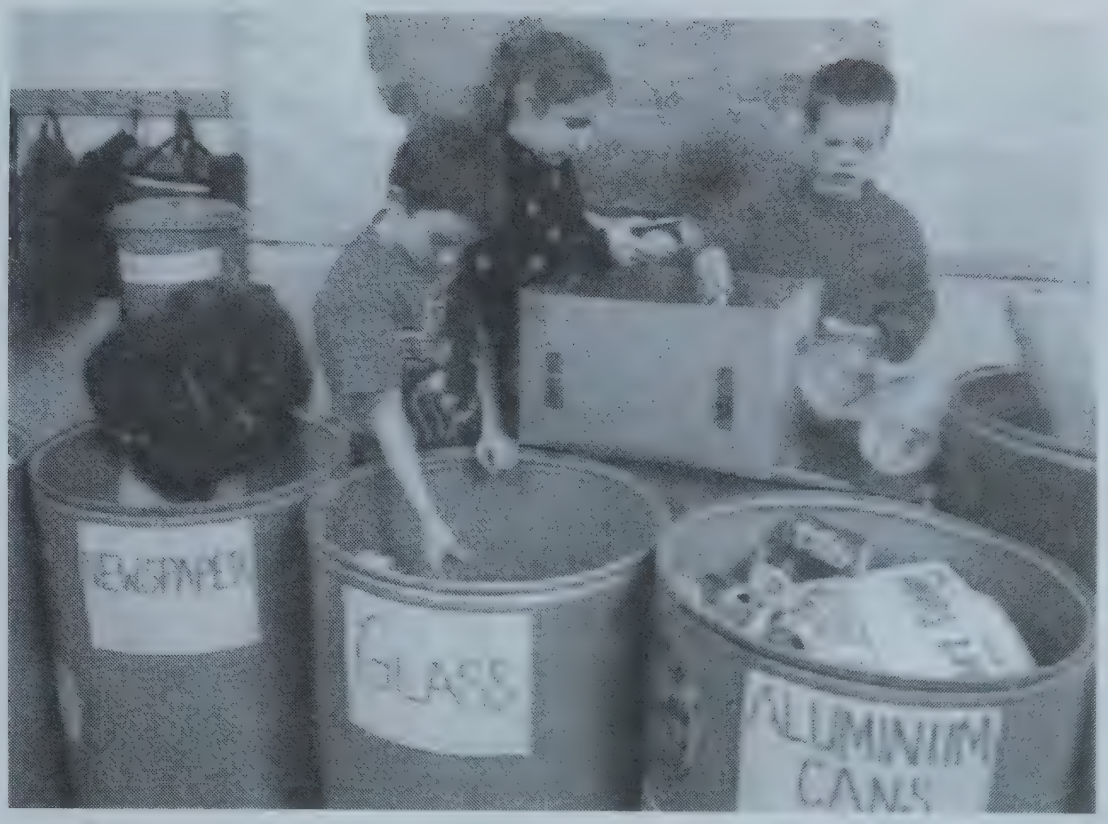
Today's industrial economies are founded on the use of vast quantities of materials and energy. The economic status of the nations has often been equated with the amount of natural resources they consume. But prosperity need not be used in a building that lasts hundreds of years or in several cans that may end up in a dump after one use. A few hundred grams of glass may be fashioned into a bottle, reused 50 times, or one immediately discarded.

The amount of materials that originally enter the economy tells us nothing about the material's eventual fate or its contribution to human well-being. But it does tell us a good deal about the damage that economy has inflicted upon the environment.

Mines, forests, oil fields and other sources of raw material are largely out of sight and out of mind for those who eventually use their products. But each year, raw material extraction - mining, logging and the like - damages or destroys millions of acres of land and forests and produces billions of tonnes of solid waste. It also pollutes the air and water to the degree exceeded only by the world's production and use of energy, much of which is generated to extract and process materials, anyway.

The waste generated by industrial economies that use these raw materials is more familiar. This rubbish presents a massive disposal problem which continues to grow (often faster than pollution). Though the symptom gets the attention, politicians rarely diagnose the disease: Global Economy Built on the inefficient use of raw materials and energy. As a result, usual prescription - increasingly more sophisticated technology for destroying the waste allows the illness to progress unchecked.

By attacking the problem at source, societies can move beyond treating the symptoms of their rampant consumtion. Preventing waste through more efficient use of resources can both cut the garbage problem down to size and reduce environmental damage for producing raw materials.



Recycling helps prevent pollution by reducing the amount of solid waste that must be dumped or burned. These children are sorting rubbish for a school recycling programme.

What is recycling?

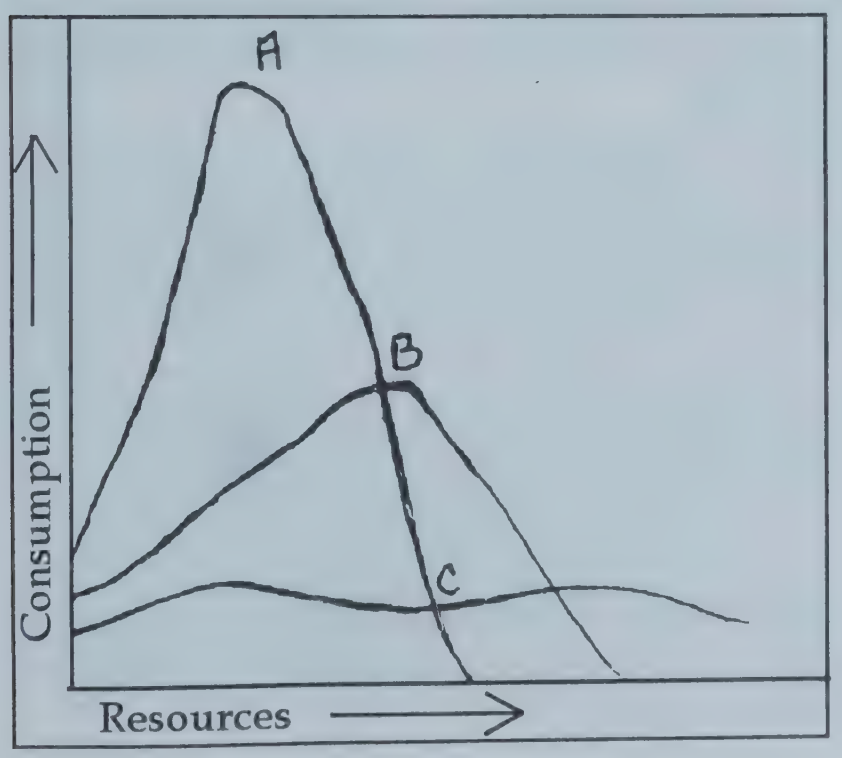
Recycling involves collecting discarded materials (such as glass, paper, metal and organic wastes), processing these materials and making them into new products.

What are the benefits of recycling?

There are six main benefits.

1. Recycling reduces the amount of solid wastes requiring disposal
2. Recycling saves natural resources, including non-renewable resources such as petroleum
3. Recycling reduces the amount of energy needed to manufacture new products
4. Recycling reduces the pollution and destruction caused while obtaining new raw materials
5. Recycling provides employment opportunities
6. Recycling helps the national economy when fewer raw materials have to be imported.

In addition, Recycling combined with improved resource-use, improved technologies and reduced resource consumption can significantly extend the availibiltiy of our natural resources.

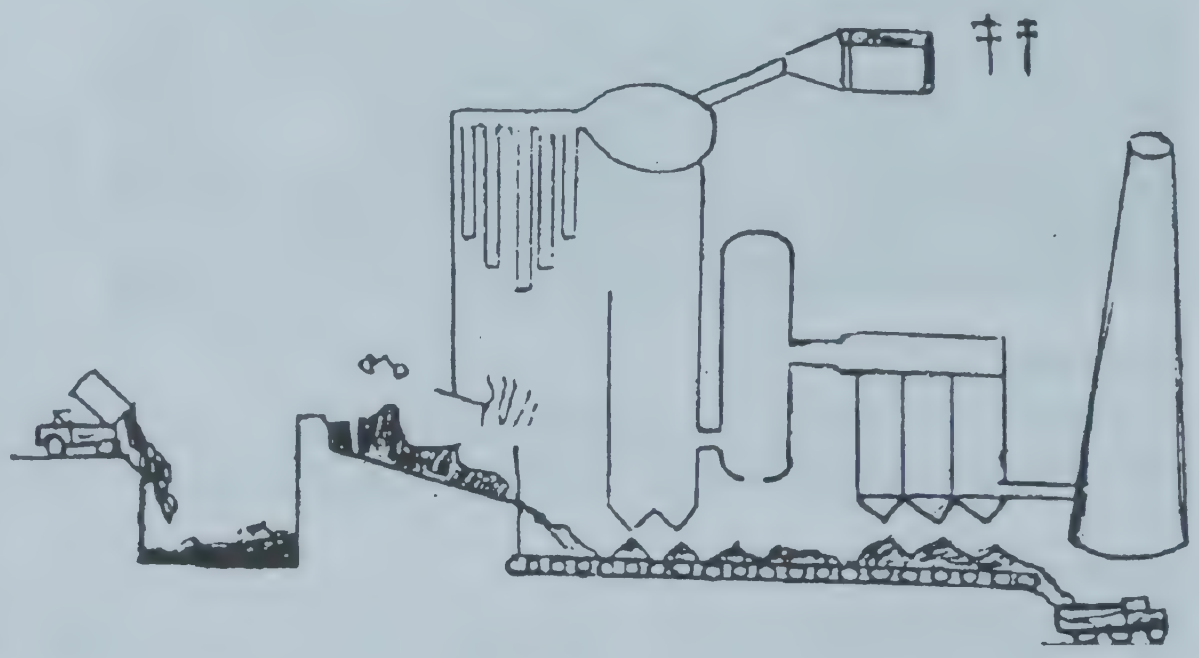


The graph shows three possible depletion patterns for a non-renewable resource. Pattern A shows what would happen to the available quantities of a natural resource if there is an expanded use of that resource. Patterns B and C illustrate that this rapid rate of depletion can be slowed down significantly by reducing consumption, reusing and recycling products made from that raw material.

Source: Miller G. Tyler Jr in Environmental Concepts, Problems and Alternatives, Vadeworth Pub., Belmont CA 1975 and revised edition 1982

Incineration Plants

Near populated areas, large furnaces are used to burn wastes. This processs of burning wastes is called "Incineration". At resource recovery plants, recyclable materials are removed from the waste before it is burned. At waste-to-energy plants, the heat generated by burning the waste is used to create electricity (see diagram). What is left after waste is burned, is bottom ash at the bottom of the incinerator. There is also ash that floats up in the hot air. This is called fly ash. Fly ash can be caught in pollution control devices. Disposing of both types, especially fly ash, is a problem because they usually contain high concentrations of dangerous toxins such as heavy metals and dioxins. Among other harmful effects these toxins cause cancer. The ashes are generally taken to landfill sites and buried. When rain washes through the landfills, it mixes with the chemicals in the ash, forming leachate. Leachate contains toxins and can run off into nearby streams and pollute them or leak through the ground into groundwater, which may pollute drinking water. Now all over the world, incineration is reserved as the last resort and used mainly for treating infectious wastes.



Does incineration have any drawbacks?

Yes, Most importantly, it is a destructive process that wastes both materials and energy. Though many incinerators produce energy, the amount recovered is considerably less than that needed to produce the items they burn. For example, recycling paper can save upto five times as much energy as can be recovered through incineration, though the amount varies substantially with the type of paper.

Burning garbage is not a clean process. It produces air and water pollution and tonnes of toxic ash. High temperature combustion breaks chemical bonds in products containing toxic metals. These substances left in incinerator ash and buried in landfills, can leach into groundwater. Incinerators pump into the air, nitrogen and sulphur oxides (which can create acid rains), carbon monoxide, acid gases, dioxins and furans (extremely toxic substances suspected of causing cancer and genetic defects), and 28 different types of heavy metals, including lead, mercury and cadmium.

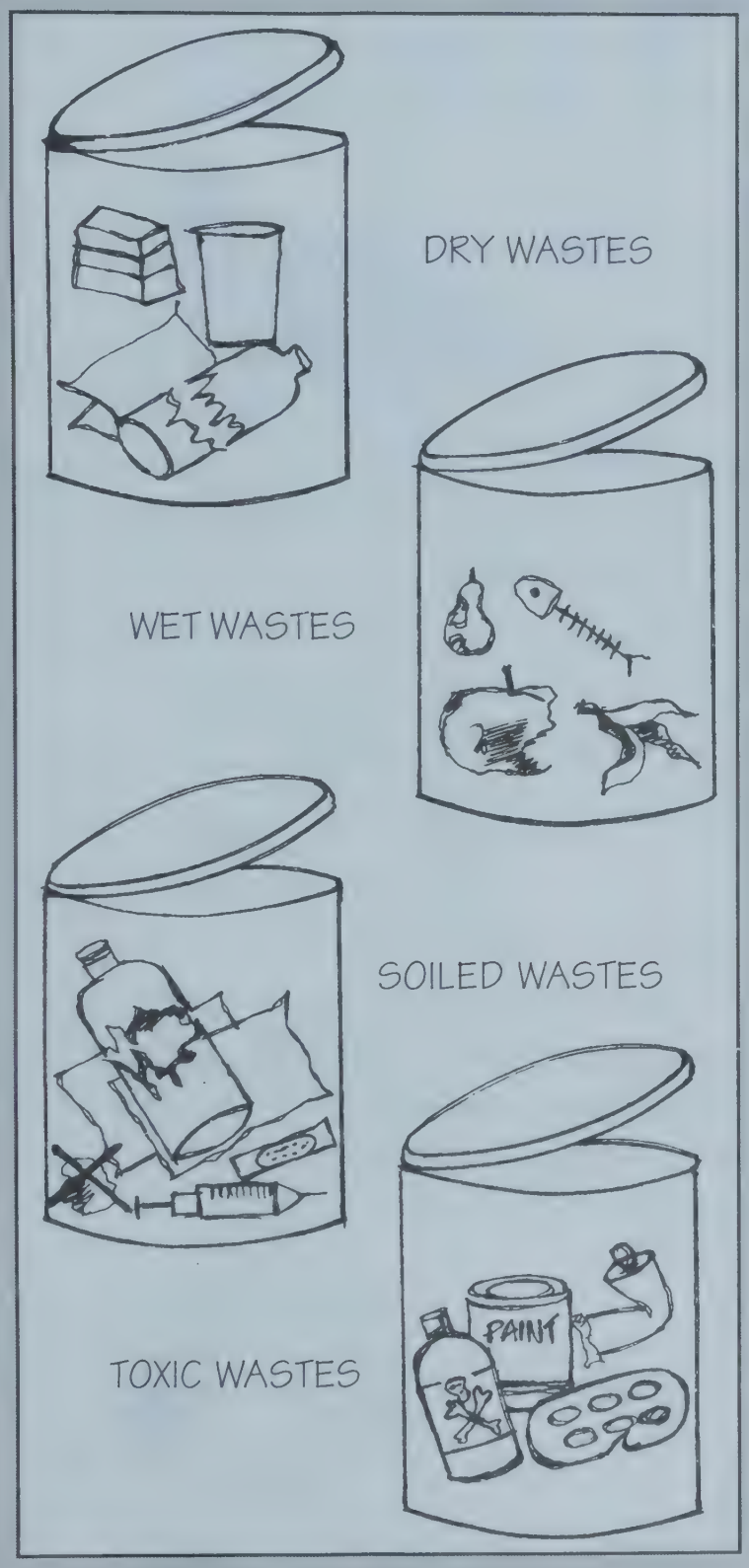
Can't any of this pollution be prevented?

Yes. Filtering devices can trap these substances, but such equipment is expensive, and air pollution controls create additional toxic ash. Some highly toxic pollutants, including mercury, are not adequately controlled by such equipment.

Module 5- Segregation

Background Facts :

In India, nearly 10% of packaging materials and containers such as boxes, plastic bags, bottles, tins etc., brought into the houses or offices are retained for reuse. Of this, 2-3% of material like old newspapers, magazines, milk sachets, bottles, carrybags, etc., are segregated and kept for sale to the Kabadiwala. About 10-12% of the total garbage generated in Bangalore city is also retrieved from roadside bins and dumpsites by ragpickers or waste retrievers and is thus made available for recycling. Recycling of products saves resources, energy and reduces the price of items. However, care must be taken to ensure that the processes used for recycling are clean and do not pollute the environment. Besides paper, plastics, glass, metal which are mainly reused or recycled, garbage that is generated in our homes also contain a large amount of organic waste (left over food, fruit and vegetable wastes, etc.,). If kept separately, these can be composted to yield a rich, pure, organic manure. Mixing the recyclable wastes with the other wastes renders the recyclables dirty and unusable. To a certain extent, some soiled and toxic wastes such as batteries, chemicals, paints, insanitary wastes are also present in our domestic garbage. Mixing of the organic wastes or the recyclables with these items will render both the former categories useless. A garbage bin in which all the garbage is dumped together is very dangerous to the health of not only the residents but also of the corporation workers, ragpickers or waste retrievers who handle the garbage everyday. They are actually doing us a great service, but, are unknowingly exposing themselves to all sorts of diseases and health hazards. In view of the potential health hazard and hazard to the environment, wastes must be segregated into four categories at the source itself, rather than mixing them and then attempting to segregate at the bins or dumpsites.

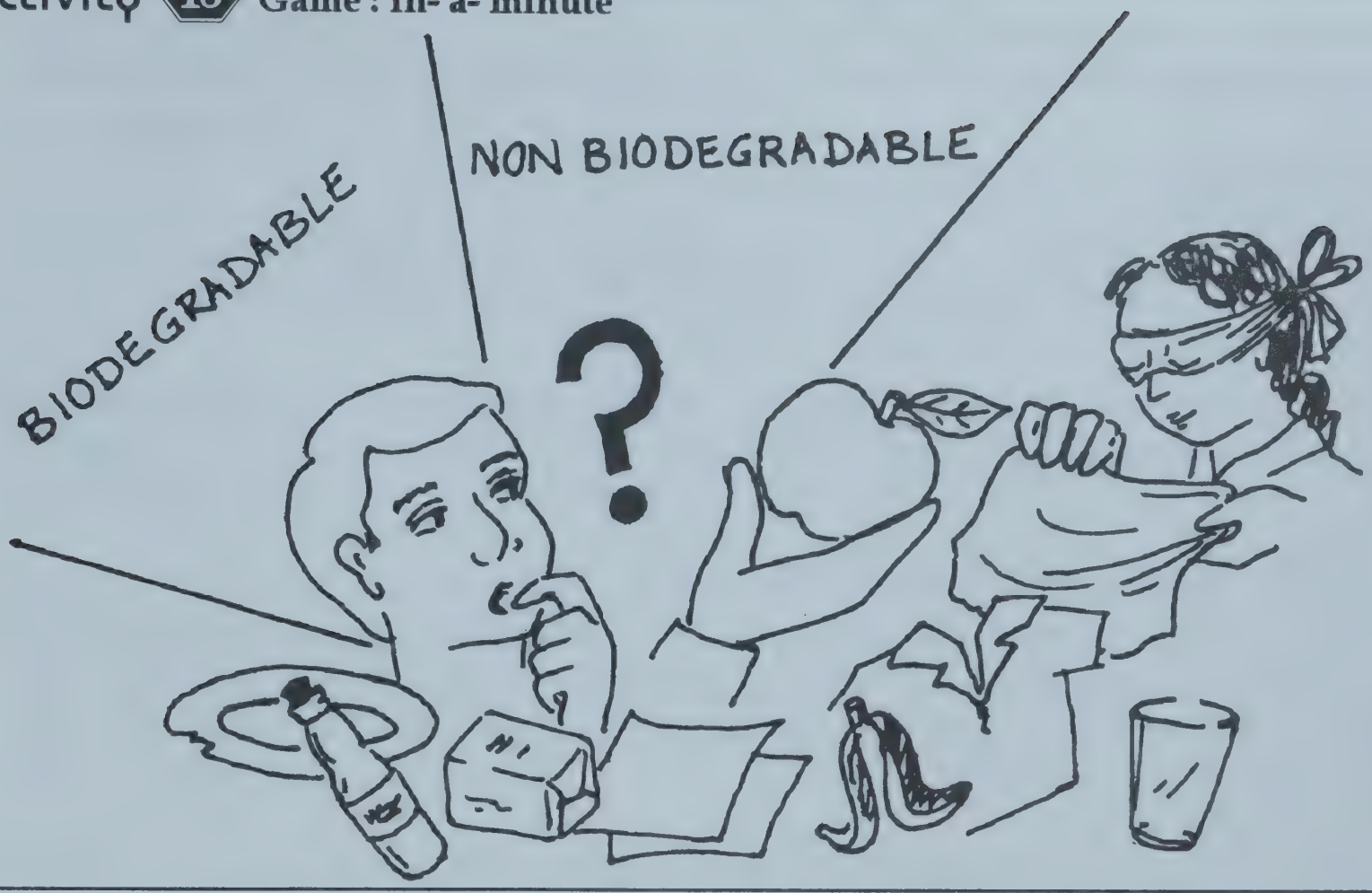


Activity 17

Appropriate methods of disposal of different categorties of garbage :
(The poster on Segregation may be used by the teacher)

Categories of Garbage	Appropriate method of disposal
a) **Organic Waste :** Leaves, fruits, flowers, vegetable peels, cooked food, other kitchen wastes and garden litter, all form organic wastes.	Must be collected separately and converted to compost.
b) **Recyclables :** Paper, plastic, metal, glass, etc. are dry and called recyclables because these materials are processed and are used to make more materials of the same kind. e.g. Waste paper, rags and agricultural wastes is pulped and used to manufacture more paper.	Must be collected separately in a basket and handed over to the ragpickers or Kabadiwalas.
c) **Soiled :** Materials that are blood stained or stained with other body fluids are categorised as soiled.	These wastes must be collected separately, securely tied and left for the Corporation to dispose off in sanitary landfills.
d) **Toxic :** Chemicals, paints, broken tubelights	These wastes must be collected separately and left for the Corporation to dispose off in sanitary landfills. Bulbs, old medicines, spray cans, containers of fertilisers and pesticides are hazardous to health if dumped simply in the garbage bin.

Activity 18 Game : In- a- minute



Keep a mixed pile of different items such as paper, plastic tin, aluminium, metal, packaging, different fruits, models of fruits and vegetables, leaves and other degradable and non-biodegradable matter that you can think of.

Keep four tubs at a distance of 5 meters (15 feet) from the pile, two on either side.

One of the tubs on each side must be marked `biodegradable' and the other should be marked `non-biodegradable'.

Next, select two students to play the game.

The aim, of the game is to enable the students to decide whether each article is bio-degradable or otherwise and put it accordingly in the appropriate bin.The student who has the most number of correct items in the appropriate bins is adjudged the winner. An interesting variation could be to blindfold the students and see if they are still able to classify the wastes correctly using other senses such as touch and smell.

Activity 19

This activity is to show children that some things which are thrown out have value.

What might constitute to be waste to one person and not to someone else?
Set up a " swap box" where the children can bring their old toys or objects that might be thrown out. they can trade an old toy for another one that is new to them. An alternative would be to set up a collection box for ragpickers.

Extension :
As a homework assignment, ask the children to write a short story, real or imaginary, describing something valuable that they found buried in the swap box. The stories should

include accounts of the previous owners and reasons as to why the objects were thrown away. Explain to children that one way to make something last longer or extend its life is to share it with someone else, once you have outgrown it or are tired of it.

Activity 20 Why do garbage bins stink?

It is because 70% of the contents of the garbage bin in our neighbourhoods consists of organic wastes which when left in the open, putrifies. It thus attracts flies, pigs, dogs and rats, all of which serve as vectors of diseases.

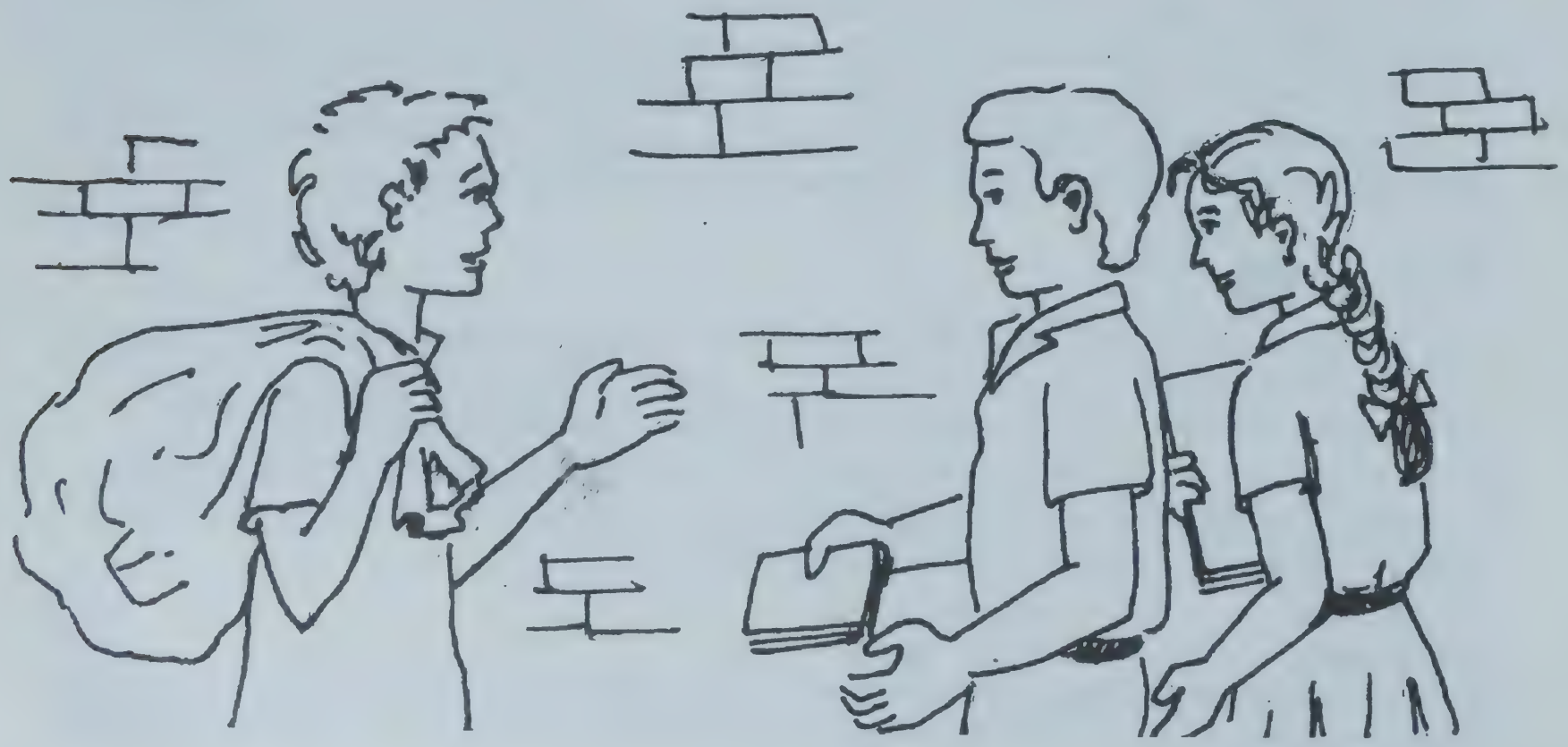
Anybody who observes the garbage bin will invariably find a ragpicker rummaging through the garbage at some time or the other.

Activity 21 Interview a ragppicker

Here are some probable questions the students could ask the ragpicker :
1. What does a ragpicker look for in a garbage bin?
2. What does she/he do with it?
3. How much does he/she earn per day?
4. Does he/she often fall ill?
5. Is he/she wearing protective gear like gloves, boots, etc.?
6. How can we help the ragpickers?

Activity 22

Have at least 2 students write down what the ragpicker answers. The class could later be divided in two groups and each group could be asked to write about two paragraphs each on what they learnt/experienced from the interview. These could be combined and made into an article for the `Garbage to Gardens' Network Newsletter. When done, send it to CEE South.



Module 6 - Reusing And Recycling

Background Facts :

Recycling of waste material is an important aspect that will definitely go a long way in solving the garbage problem. Recycling refers to the process by which material once used and discarded is used again to substitute for virgin material.

Most household garbage is recyclable. Paper, plastic, metal, glass and rags can be reused in various manufacturing processes. Wet organic kitchen wastes can be used to generate compost, which is rich in plant nutrients.

In our country, most cities and towns have retailers and wholesalers who buy from ragpickers, material that they pick from garbage dumps and roadside bins. These materials are then sorted and sent to various small and large industries which use them in varing proportions to substitute for virgin material in the manufacture of articles.

Recycling has several benefits. It reduces the amount of waste that reaches the roadside bins. If managed properly it reduces the amount of energy needed to make new products. It reduces the requirement for virgin material and it generates employment.

But more recently, it has been recognised that the processes used by the recycling industries are often harmful to the environment and to the health of people involved in the recycling industry. The technology used for recycling should also be safe.

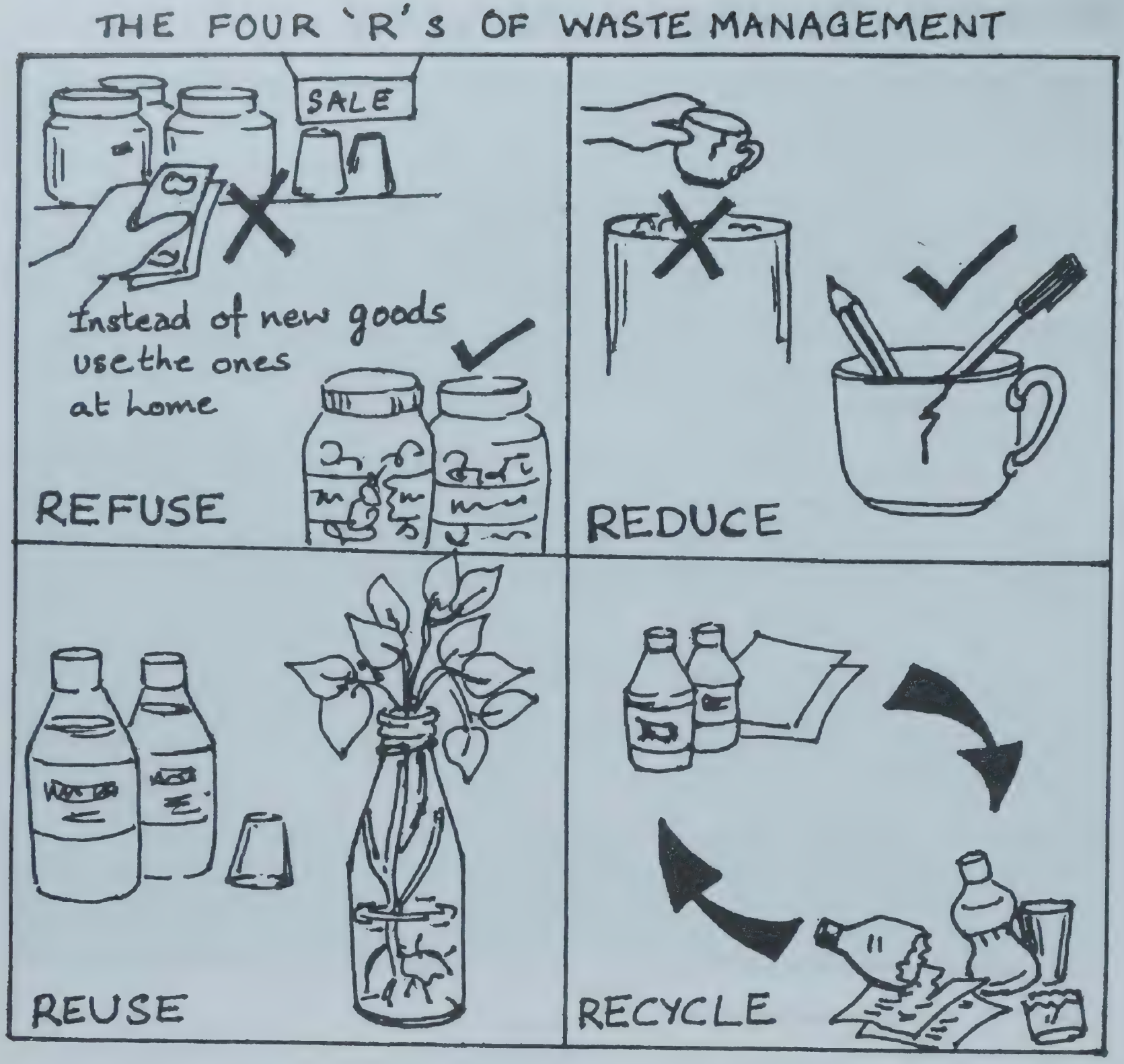
The "4 R's" of Waste management :

Refuse : Refuse to buy anything you do not really need!

Reduce : Reduce the amount of garbage generated. Make sure that whatever is being thrown is being done so after it has been used and reused to the maximum extent possible by you.

Reuse : Reuse every item to its maximum after properly cleaning it or for an appropriate use only. For example, do not use a bottle which contained pesticides for storing water.

Recycle : Keep items which can be recycled to be given to ragpickers or itinerant waste pickers (Kabadiwalas) or agents. However, covers or containers of poisons or chemicals should not be given for recycling. They need to be carefully disposed off as they are toxic. Similarly, soiled and insanitary material should be properly disinfected before recycling. If not possible, such material should not be recycled.



Activity 23

Write the word `recycle' on the board or a large sheet of paper. Next to it draw a picture of a bicycle wheel. Point out to the children that both the figures end with the word `cycle'. When a bicycle wheel goes round and round, the word `recycle' would mean to use over and over again. Show the children the recycling symbol and explain to them that the three arrows represent the three stages involved in recycling materials - collect, remake and reuse. You may wish to have the children practice drawing the symbol.

Point out that when we recycle a product, it does not add to our garbage, but goes back around as something new. Just as the leaves go back into the soil to help a new tree grow, man-made materials can also be broken down to make new material. Old cans and glasses can become new cans and glasses.

Activity 24

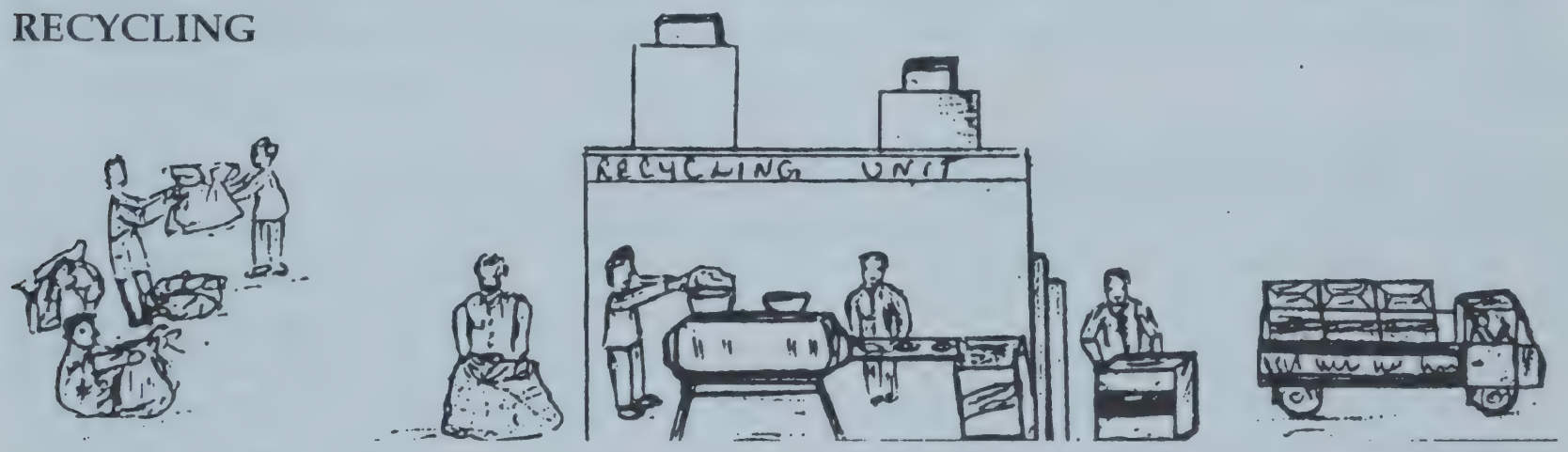
Have each child list the possible advantages of recycling. Call on volunteers to read from their lists.
Write the major advantages on the board :
1. Reduces pollution.
2. Saves natural resources
3. Saves energy
4. Saves money
5. Saves on landfill space.

Activity 25 Make new greeting cards from old ones.

This activity is to introduce the concept of recycling as an alternative to disposal.

1. Collect old greeting cards, calenders, cardboards.
2. Let the student use her/his imagination in making as many different types of greeting cards as possible.
3. These can be used by the students to send it to their friends, relatives and one another during festival times, at no extra expenditure.

RECYCLING



Activity 26 Exposure Tour

Take the children to one or more recycling plants.
NOTE : Some of these industries can be toxic and only older children should be taken, that too with permission from the parents. The children should not be allowed to touch any material in the industries and may need to be provided with face masks.
1. Glass bottle recycling plant.
2. Paper recycling plant.
3. Scrap metal recycling plant.
4. Organic matter composting plant.

Activity 27

Ask the students to write an essay on the advantages and disadvantages of recycling. They may be led to focus upon the various points of view of environmentalists, recycling manufacturers, the workers there, ragpickers, middlemen and themselves. The best two or three essays could be sent to CEE South to be printed in the "Garbage to Gardens" Network Newsletter.

Recycling Paper

Only 15% of the world's paper is made in the developing countries. But, many of these countries want to cut down on the amount of paper they have to import and hence they are trying to increase their own production of paper. As a result, the Third World has become about 85% self sufficient in paper.

It is believed that of the paper produced in developing countries, only a third is made from wood-fibre. Another third comes from non-wood fibres such as straw, bamboo and sugarcane bagasse. The final third comes from recycling waste paper. This emphasis on recycling has economic and environmental benefits. It helps to conserve both material and finances.

Paper can be made from waste paper and even from other waste materials such as old clothes, rags and crop leftovers (stalks). Making paper from waste products is not a new idea. Nearly 2000 years ago, T'sal Lun, Minister of Agriculture in China, discovered how to make paper from a varietyof substances ranging from the bark of the mulberry trees to old fishing nets and waste hemp.These were soaked and beaten into a pulp. The pulp was then placed upon a special bamboo rack from which all the water was pressed out. The sheets were dried in the sun. For the next 500 years, the art of paper making stayed in China.

The process of making paper involves making pulp. When you tear a piece of paper, at the torn edge, you can see fine , thread-like wisps. They are clearer if a magnifying glass is used. These are fibres. Paper fibres consist of cellulose - the material of which plants and trees such as wheat, rice, sugarcane are made. The materials can be used to make paper by breaking the fibres loose and free from the substances that bind them. This process is called pulping and the mass of fibres suspended in water ready to be made into paper is called pulp.

A papermaking machine was the first device that could produce paper in a continuous roll rather than in single sheets. Nicholas Louis Robert invented the machine in 1798.

Activity 28

This simple process can be done in class or at home and the children can be encouraged to make paper out of waste material.

a) **Making the pulp**

Materials you will need : Old paper such as newspaper
Stirring spoon
Container
Water
Corn starch (optional)

Procedure :

1. Remove any kind of staples or pins in the paper and tear the paper into small pieces (maybe two square cms). Place these scraps of paper in a container.
2. Pour water (hot water, if possible) in the container such that the water stands about 1 cm above the paper layer. Let it soak for 3-4 days. Stir the mixture everyday to help break the paper fibres down.
3. When the shreded paper suspended in the water looks like a thick soup, it is ready for use.
4. Corn starch may be added to the mixture for smoothness and stability.

b) **Making paper :**

Materials you will need : A flat dish, Pulp
An old net streched over a picture frame and secured with pins or a fine sieve (the kind used in the kitchen to sieve flours)

Procedure : Refer Chart 3

1. Pour some pulp on the sieve.
2. Spread the pulp out onto the sieve as evenly as possible and in any shape you want (once the paper is made, it can be cut into any shape).
3. Place a sheet of paper, preferably blotting paper, over the pulp on the sieve and press out as much water as you can.
4. Turn the sieve upside down on top of a sheet of paper or wooden block and lift the sieve away.
5. Dry this sheet of handmade paper in the sun for about 2 days. When dry, peel the sheet off the paper or wooden block.

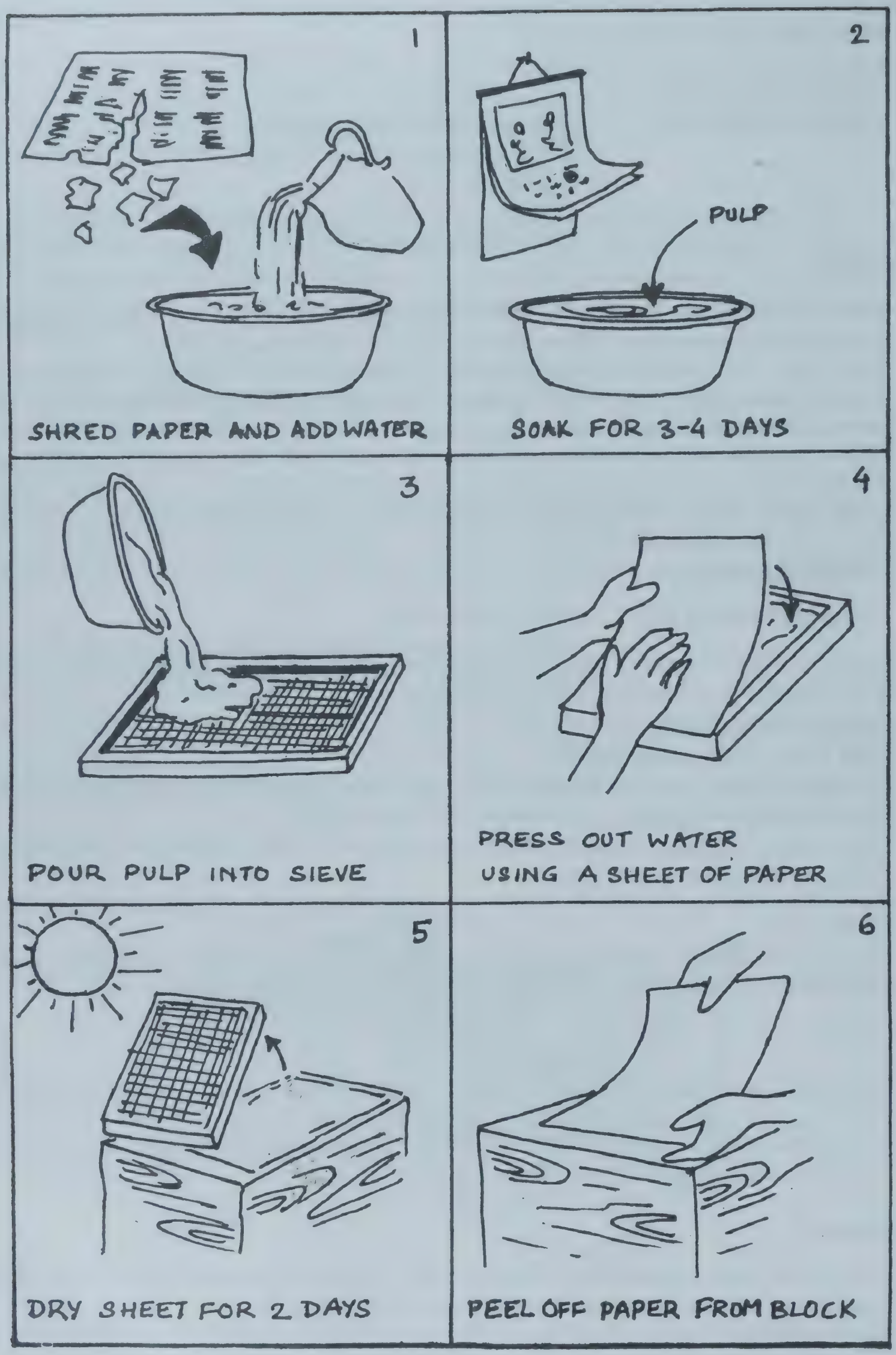
In addition :

- Add small amounts of shredded/grated vegetable wastes (for example: orange peels, carrot tops) to the paper pulp and observe the colour and smell of the paper made.
- Add to the pulp turmeric for yellow coloured paper, kum-kum for red coloured paper and so on for getting different coloured papers.

Discussion :

a) Use the recycled paper for painting or drawing with charcoal pencil or ink. How is this paper different from other writing or drawing paper?
b) How are energy and natural resources conserved by making recycled paper instead of new paper?

CHART 4


1
SHRED PAPER AND ADD WATER
2
PULP
SOAK FOR 3-4 DAYS
3
POUR PULP INTO SIEVE
4
PRESS OUT WATER
USING A SHEET OF PAPER
5
DRY SHEET FOR 2 DAYS
6
PEEL OFF PAPER FROM BLOCK

Module 7 - Sanitary Landfills

Background Facts :

A sanitary landfill is a place to bury waste comprising mainly of soiled and toxic wastes in a systematic and hygenic way without causing any nusiance or hazard to public health or safety. The bio-degradable portion of the refuse undergoes anaerobic decomposition over a relatively long period of time and produces gases such as methane (CH_4) and Carbon-dioxide (CO_2). The process of decomposition also produces a liquid termed "leachate". This is highly toxic and can poison the soil and the underground water in the area surrounding the landfill. It is very important to see that this leachate does not reach the soil or groundwater. For this reason, landfills are lined with special liners which are impermeable, forming a barrier between the leachate and the land.

The process basically consists of laying the waste material in a planned and methodical manner, then compacting the layer and finally covering it with soil. The soil cover tends to remove common landfill odour and keep away flies, rats and other vectors from thriving on the wastes.

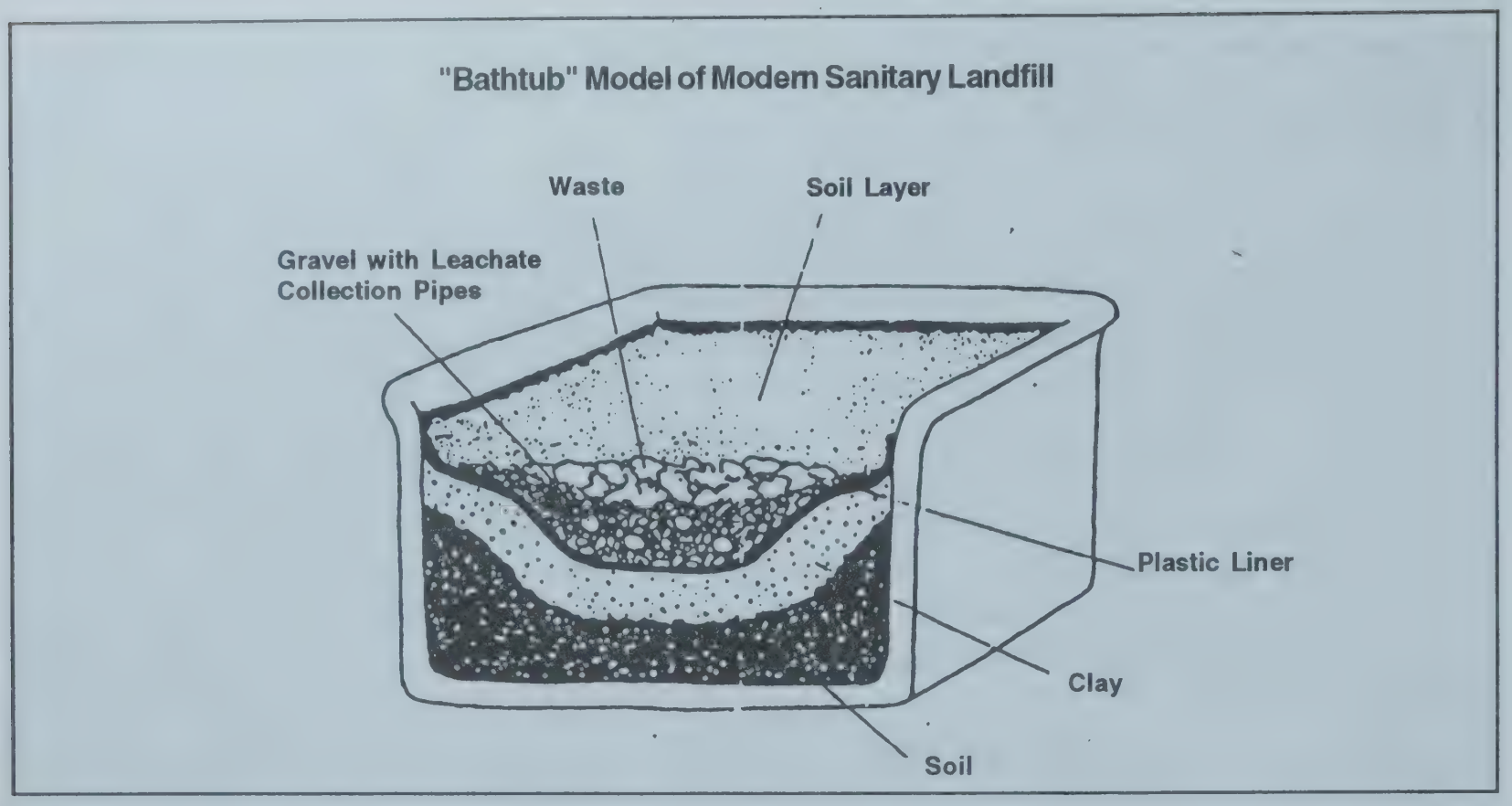
The wastes which may be disposed of by the sanitary landfilling method are soiled and toxic municipal wastes, demolition and construction wastes, industrial wastes, dead animals, hospital wastes, animal husbandry wastes and such other material. Oil, solvents, volatile solids and sludges and other hazardous wastes can be used for recovering valuable material after which they can be disposed in sanitary landfills separately from other wastes.

Houses and apartments should not be constructed on landfill areas because of potential problems from gas emmision, corrosion, inadequacies in the foundation and settlement besides soil and water pollution. The area may be used as car parks, bus stands, etc. Light structures may be constructed on such sites.

Activity 29

Draw the figure given overleaf on the board and explain that this is an example of one of the more protective landfill designs. Highlight the layers of soil, clay, gravel along with collection paper, plastic lining and waste. Newly collected waste is covered by a layer of soil. Tell students that these landfills control the "leachate" so that it does not contaminate the soil and groundwater.

A Model Sanitary Landfill



Leachate is the term used to describe that liquid that is formed due to anaerobic fermentation and which percolates through some material, in this case, the various layers of the sanitary landfill.

As a classroom activity, construct a mini sanitary landfill in a large glass bottomed box. Line the bottom with a thick layer of soil, above which place a layer of clay, plastic sheet and a layer of gravel. Next, place a variety of wastes (metal, food, paper, plastic) into the gravel layer and cover with a light layer of soil. Occasionally sprinkle water to simulate rainfall, observe changes in the waste material over time and watch for "leachate" collected at the bottom.

Activity 30

"Which of the items in your daily household garbage would you put into a landfill?" Ask the children this question. The answer is, of course, the soiled and toxic wastes.

Activity 31

Ask the children to find out how many sanitary landfills or other kinds of landfills are present in the town or city. This information could be got from the municipality or corporation. Also ask the children to find out what are the problems associated with open dumps and sanitary landfilling.

Module 8 - Gardening with Garbage

Background Facts :

Composting is one of the oldest forms of recycling. It is based on the scientific principle that nothing ever really disappears, but changes shape and takes on new forms. When leaves fall and decompose, they are broken down over time by weather, micro-organisms and earthworms. Organic wastes (remains of living matter) can be buried in the soil to make compost or humus, the rich black dirt formed by the decomposition of animal and vegetable wastes.

Compost is formed through the action of certain microbes that multiply when mixed with organic wastes and receive sufficient air and water. The finished product, high in carbon and nitrogen, looks just like soil and is an excellent medium for growing plants. In addition to being clean, safe and thrifty, composting can also significantly reduce the amount of garbage a family sends to the garbage bin.

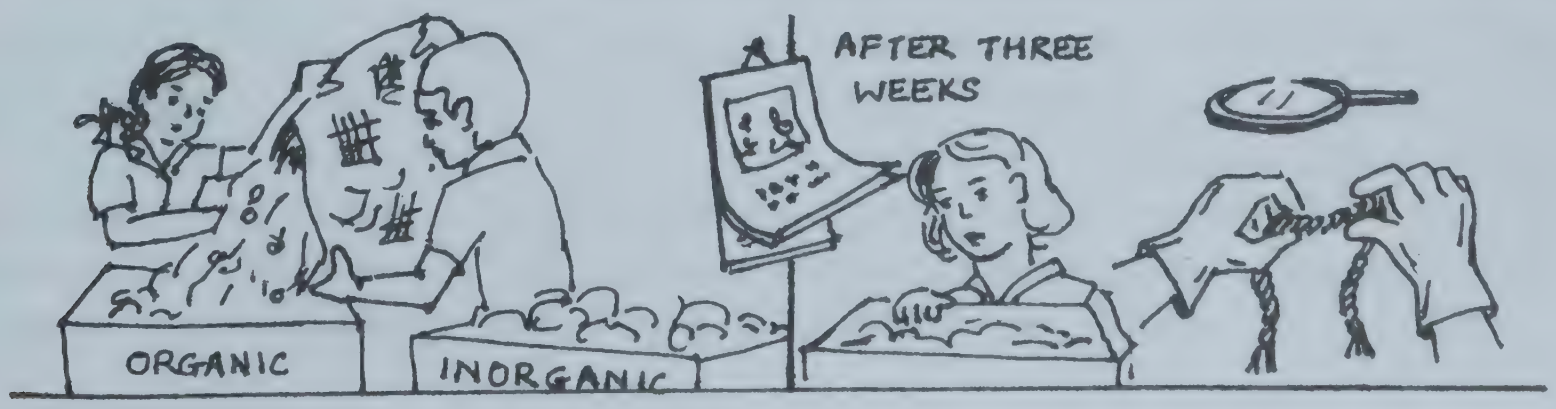
Benefits of the compost

To soil :

1. Compost application decreases drought damage by increasing the soil's ability to hold water.
2. Compost makes soil easier to cultivate.
3. Compost supplies part of the 16 essential elements needed by plants.
4. Compost helps decrease the adverse effects of excessive alkalinity, acidity or excessive application of chemical fertilisers.
5. Compost lets soil retain more plant nutirents over a longer period.
6. Compost improves the physical and chemical characteristics of the soil and increases its biological activity

As mulch :

1. Compost decreases rainfall runoff and evaporation, making more water available to plants.
2. Compost keeps soil cooler in hot weather and warmer in cool weather.
3. Compost helps prevent freeze-thaw activity which can injure the plant roots or even push plants out of the soil.
4. Compost helps prevent wind erosion by keeping the soil covered.
5. Compost helps control the growth of weeds.



Activity 32 Begin with some questions

1. **What is composting?**
   It is the process of natural decomposition of organic waste yielding a substance called compost or manure which is rich in nutirents.

2. **What are the essential ingredients for proper composting?**
   Organic wastes, bacteria and water.

3. **How does composting reduce the amount of vegetable waste?**
   By composting the waste that we produce in our kitchens, we are assuring that organic matter is neither wasted nor carelessly thrown into the garbage bin and left to rot. Instead, composting is a method of recycling nutrients, whereby nutrients go back to the soil again.

Ask the children to collect some wastes, such as tiny bits of paper, leaves, metal, twigs, cotton rags, rubber, fruit peels, weeds, left over plastic , etc. Collect some large cardboard cartons or glass jars and ask the children to divide the collected waste into 'organic ' and 'inorganic'. Put both the categories in different cartons or jars. Mix both set-ups with some soil. Keep the cartons or jars in sunlight. Do not cover it with a lid. Let the children sprinkle some water every alternate day. Leave this for a week. After a week, make the children empty each carton or jar onto a large newspaper sheet. Ask them to observe how many of the original material they can identify in the semi composted matter. You may need to make magnifying glass and gloves available to the students. Repeat each of these experiments for three weeks.

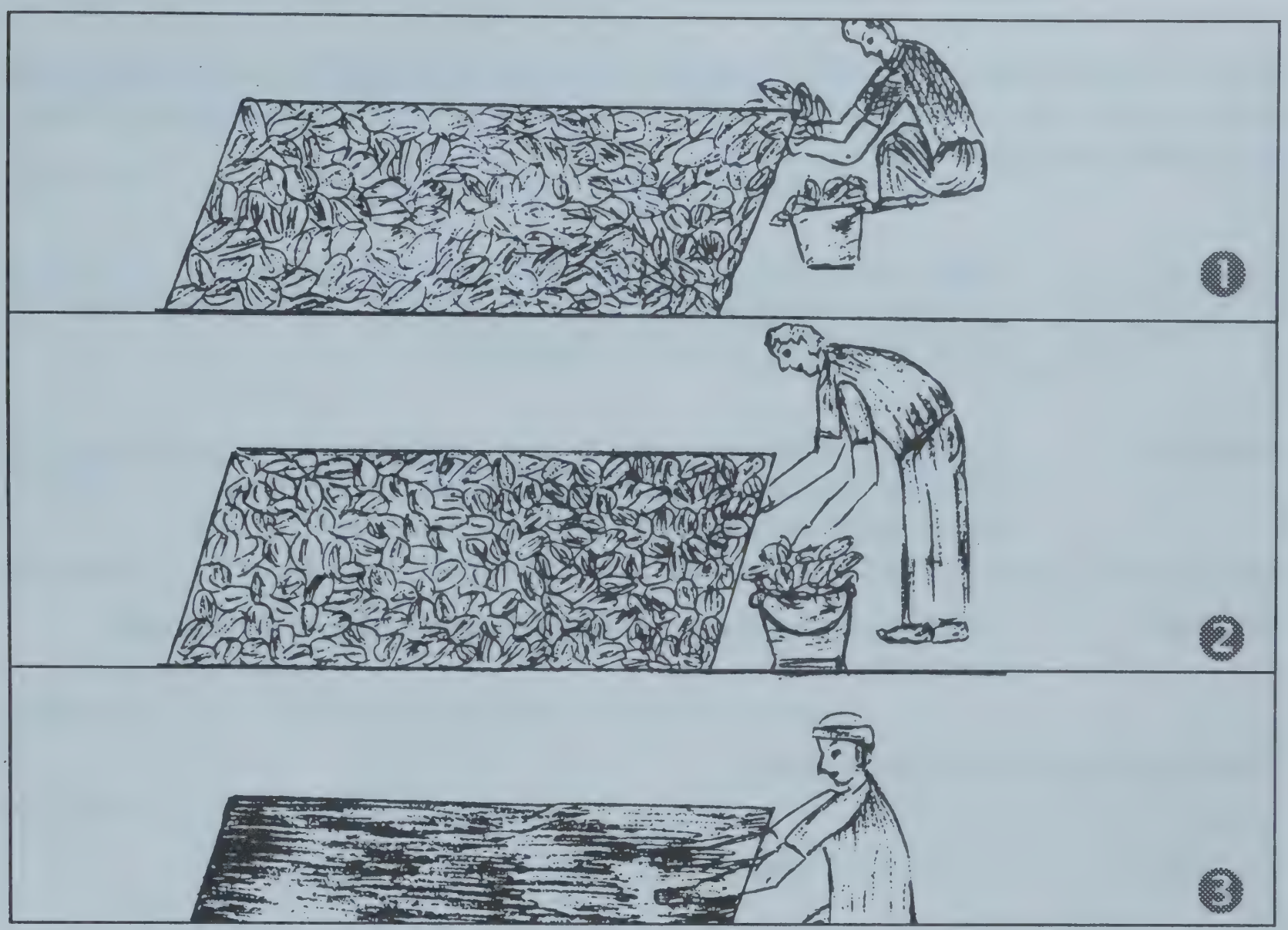
Activity 33 Discussion

After three weeks, encourage the children to compare their observations for similar and different findings. Discuss which objects decompose the fastest and which objects do not decompose at all. Ask them why they think certain objects decomposed while others did not.

Extension

Once they realise that organic matter can be composted and that composting is a method of recycling nutrients, they could be asked to make a compost pit, collect organic matter in it, mix it with soil and allow the contents to compost. A very interesting activity would be to encourage the children to make a garden. They could use the compost so made by them for the plants in the garden.

Activity 34 Making a Compost Pit



Choose a cool, shady corner in your school compound or garden where you can dig a pit. Generally, the dimensions of the pits are 6'X4'X3' as illustrated in the diagram. Although the length and the breadth of the pit may be altered, the depth of 3 feet is found to be convienient for aerobic composting, as it involves turning of the waste in the pits at fixed intervals. If there is money available, it is advisable to line the pits with granite or brick and cement. This will avoid the problem of rats and other burrowing pests from interfereing with the system. The pit should be covered with a net or mesh to keep away flies and birds.The most important reason for lining the pits is to prevent Nitrite Pollution of the sub-soil water which is known to be highly toxic.

The composting process

Put the organic matter into the pit every day (1) and cover it with a thick layer of leaves (eg. dried leaves swept off as garden litter) (2). If dried leaves are not available cover it with a thin layer of soil. This will prevent bad odour while allowing air to enter the pit. The waste needs to be turned once in three days to hasten the process of composting. The organic wastes collected each day can be put in the pits and covered with leaves or soil. At the end of 45 days, you will have pure, rich, organic compost. (3)

Activity 35 A Musical to be staged on Parents' Day in School

Scene : A roadside with a bin in view. A large, dirty, community garbage bin can be seen on one side of the stage. Two benches that represent public seats are placed at the other side where four children are watching and commenting.

Student 1 : Filthy garbage, filthy garbage, filthy garbage everywhere.
No one's cleaning, no one's cleaning, no one's cleaning anywhere.
(to be sung in the tune of 'Clementine'.)

Student 2 : It smells so filthy and looks so dirty, how can we play anywhere?
So many flies and mosquitoes, very dirty, everywhere.
(as above, to be sung in the tune of Clementine)

Student 3 : Did you see that there is more garbage all around the bin than inside it?

Enter servant with dustbin full of garbage.

Student 4 : Who throws it like that?

Servant advances towards the roadside garbage bin.Servant stands a few feet away from the garbage bin and attempts to throw it in the garbage bin from this distance.

Altogether : Hey! STOP!

Student 1 : Gangamma, why are you throwing the garbage outside the bin?
The entire road will get dirty because of this.

Student 4 : Look, so many plastic covers and waste paper here. Now it is so dirty after being mixed with all the other wastes that it cannot even be recycled.

Student 3 : All this comes from our very own homes. It is thrown by us. But where do these things really come from - originally?

All together : The Earth!

Student 2 : Paper comes from trees and plastic from petroleum, glass from silicon or sand and metal mined from the earth.

Student 1 : Natural Resources, all of them! What nature forms carefully and slowly over millions of years.

Student 4 : And how do we throw them? In one simple, fast action.

Student 3 : The more we throw, the more garbage we create. The garbage keeps piling higher and higher. I do not like living near a garbage bin. A dirty garbage bin is a shame - it is like a showcase of filth.

Servant : Then we should all reduce the waste that we create.

Student 1 : Exactly, this is the first of the four 'R's that they taught in our eco-club.

Student 2 : No it is the second. The first 'r' is Refuse.

Student 3 : Refuse to buy what we do not really need. We need to learn to make do with what we have and if we get bored with our toys, we can always swap toys for some time.

Student 4 : Reduce garbage - My Mom now carries her own shopping bag to market so that we do not take home so many carry bags.

Student 1 : My mother reuses a lot of glass and plastic bottles and jars as well as cardboard cartons. That way, we do not have to throw too many things away and we can also save money.

Student 2 : My Dad too reuses paper. He was telling us how in his office, the paper is used on both sides instead of only on one side .

Student 3 : My mom's office has gone even further. They have asked a ragpicker to pick up the waste paper from their office every week.

Servant : What about kitchen wastes? In our village, we put our kitchen waste for our plants.....

Student 1 : Exactly Gangamma!

Song : Inch by Inch, Row by Row,
We can make our garden grow
Using our kitchen waste for compost.
What stinks in the bin and rots on the streets
Can be made to smell fresh and sweet
When buds fed with compost open their petals.

Student 4 : Clean and Shining, Clean and Shining,
Clean and Shining everywhere.
Green and Beautiful, Green and Beautiful,
Green and Beautiful everywhere.

Chorus : Our homes are clean, our roads are too.
We can make a difference - me and you!

Taking it to te community

And initiating a community waste management programme for a better neighbourhood

Module 9 - Action Programme

Activity 36 Action Programme

Set an example for your neighbourhood. Encourage your children to organise a campaign complete with banners, pamphlets, posters, badges and all! You could think of putting up a street play to communicate waste management strategies to your neighbourhood. Any external organisation may be contacted for technical, educational and financial support.

Activity 37

Write a script for a street play which can be performed in or outside your school to create awareness regarding waste and wasteful habits. Alternatively, a puppet show could be performed. Keeping in mind the various puppet characters that you create you could design their costumes too.

Activity 38 Week-end Assignment

Tell the students to work in groups and prepare posters, pamphlets and any other campaign material. The following material from this package could be used to make posters or pamphlets.

Waste not want not
Enduring litter
Resource Tree
} in the book

The Garbage Pamphlet
The Composting Pamphlet
The Garbage Posters
} in the Kangaroo pocket in the last page of the book

Activity 39 Reach out to your community

To reach out to the community, first choose an area - may be a colony of about 200 houses around your school. The first step would be to contact the residents' association in the area and explain to them that the students from your school want to launch a " clean-up " drive in the area. The method that you need to follow for the action programme is

1. Create Awareness by going to each house in the area and asking the members to reduce waste, segregate waste into recyclables and compostable waste and throw only the rest inside the corporation bin neatly.
2. Ask them to arrange for a waste collector to collect the recyclable things. Your students could also help in identifying the waste collector, training him/her and helping the community to monitor the waste collection until it stabilises.
3. Encourage those people who have their gardens, to compost the organic wastes in their own gardens and use the compost so produced as manure.

Invite all citizens of the area for a meeting and stage a street play/drama/skit.

Give out pamphlets persuading the people to reduce, reuse and recycle wastes. If possible, the school can arrange a weekly collection of the recyclables collected in each house. This could be given free of cost to the school by the residents and the money that the school earns by selling the recyclables be used to pay the cost of the collection system. Any left-over money could go to the eco-club.

If an industry or a bank could finance two tricycles for the project, this could go round collecting the organic waste daily. This waste could be composted in a nearby park with the permission of the Municipality or Corporation. The compost so produced, could be sold off to the the residents. The money collected from the sale of compost could go towards the salary of the person who collects the waste. Alternatively, each house could be charged Rs.20/- (for a minimum of 200 houses) and this could be used to pay the waste collector.

Activity 40 Campaign against plastic carry bags.

Warning: Make the students aware that tying garbage in plastic covers and throwing it is not a good habit and contributes to waste. Both shop keepers and citizens need to be made aware that plastic carry bags are harmful to environment. Students could take out a procession carrying banners and posters saying Say No to Plastic Carry Bags and paste a poster with a similar message in all the shops in the area.

Activity 41 Hospital Waste Management.

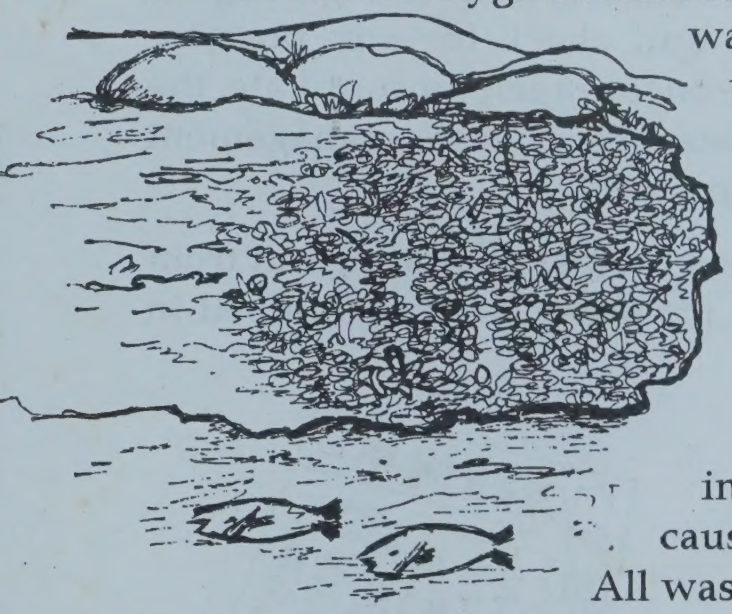
This is a very complex issue, specially since it deals with the transport, and disposal of infectious wastes which are hazardous to human and animal health. Ideally, Hospital Waste needs to be segregated as per the categories suggested in Bio-medical waste Rules and Regulations of Government of India. Segregation ensures that only the most hazardous part of the infectious wastes are incinerated - that too in a common facility for the city so that there are not too many incinerators around to pollute the air of the city. The children need to be aware about the fact that these wastes are hazardous and need to be handled separately. Arrange a lecture requesting the administrator or the head of the Infection Control Committe of a large hospital to talk to the children about the rules of managing Hospital Waste.

Activity 42 A Bed of Garbage.

The most convenient place to dump the waste is at the bottom of the lake or a river. This is a very dangerous practice. A very recurrent international problem today is the release of oil and pollutants into the waters of a river. Leachate and pollutant from garbage, a leaking tanker, the explosion of an offshore oilrig, oil as a part of the effluent from a factory - all of these can have lethal consequences for life in the water.

Nature has a great capacity to cleanse the earth and its resources. Of course, that is, if human intervention is small. In case of water, we have seen it getting polluted in many ways. The sun through its heat is a prime factor for cleaning and purifying it.

Water evaporates from lakes and rivers because of the sun's heat, forming clouds of vapour. These clouds condense to enable clean water to come down in the form of rain to replenish lakes and rivers. Sunlight also penetrates the water and helps water plants produce oxygen. The amount of oxygen available in the water is crucial to the organisms which live in that water. It is this oxygen level prevalent in the water body that ensures its purity. When sunlight is no longer able to penetrate the water, the plants begin to die and therefore oxygen gets depleted.



Plants like water hyacinth and some weeds also absorb toxic wastes from the water body and produce oxygen. But waterweeds, when they grow uncontrollably, prevent sunlight from reaching the plants and animals submerged in water. They also gradually prevent the flow of water, causing stagnation.

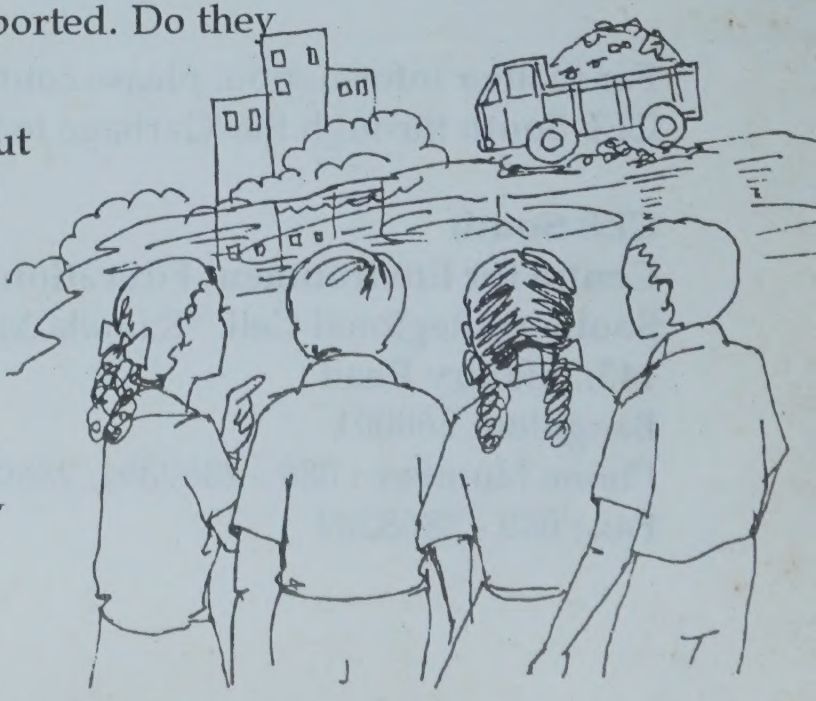
All waste that is put into the water body adds to the total solids in the water body. This increases the turbidity and reduces the amount of sunlight that penetrates into the water.

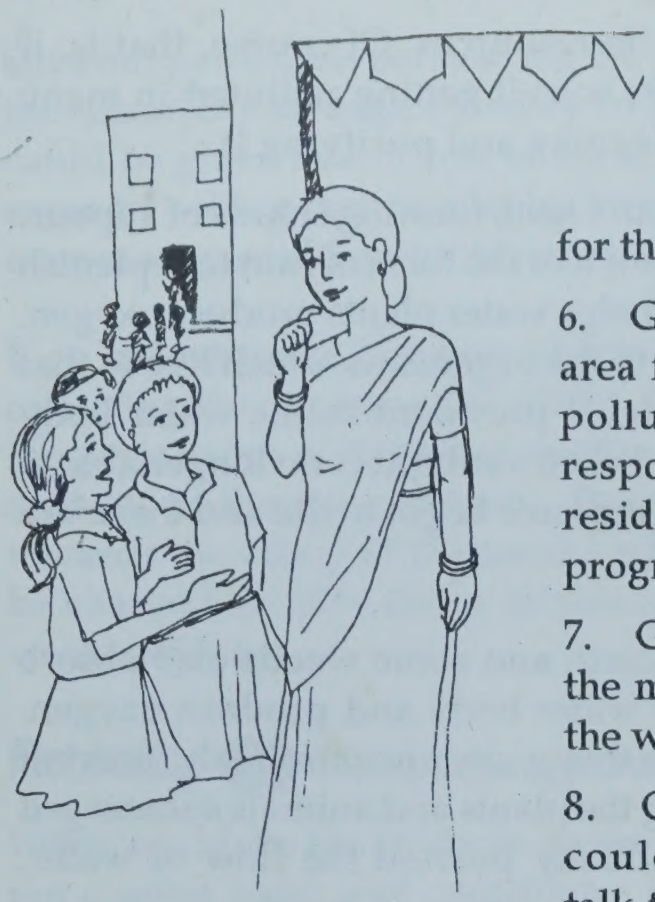
Aerobic bacteria are those that live on oxygen found in the water and are found in the upper levels of the water body. The bacteria present in the water feed on the waste that falls into a river. In doing so, they rapidly use up the oxygen present in the water. As the oxygen level falls and when it is no longer available, aerobic bacteria begin to die in the river and the cleansing the river or lake goes down.

When this happens, anaerobic bacteria that are present on the bed of the water body absorb the waste with the help of hydrogen. The hydrogen released mixes with the sulphur of the waste matter and produces hydrogen sulphide gas which further pollutes the waters.

To make the children aware that waste is being dumped in the water body near their city or town.

1. Select a water body for scrutinisation.
2. Get the children to observe closely the physical features that assault their eyes - plastic paper fluttering, thorny bushes, etc can all be reported. Do they see any garbage dumped on any side?
3. Get the children to play detectives by finding out from where this garbage is coming. This will involve waiting for the lorry and talking to a defensive lorry driver.
4. Discuss with the students why they feel that this is happening and who is responsible - there need not be just one group of people or person responsible. The class could be encouraged to try





and find as many groups as possible.

5. Divide the class into groups. Each group is assigned the task of talking to one of the many persons identified previously as being responsible for this state of affairs.

6. Group 1 could write a message to the residents of the area from which the lorry is coming that their garbage is polluting the water body and check for any positive responses. They could be encouraged to motivate the residents of the area into starting a waste management programme involving composting.

7. Group 2 may be assigned the task of finding out from the municipality as to why the waste is being dumped in the water body.

8. Group 3 could perhaps talk to the Lorry Driver in greater detail and get him to change his route plan. Most lorry drivers are under the Municipality or the Contractor and this group could also talk to the contractor

9. Group 5 could write a letter to the editor of a daily outlining the dangers of dumping waste in the pond.

10. Group 6 could ask the residents around the water body to protect it.

Of course, the entire project needs to be documented and evolved into a report to be sent to the 'Garbage to Gardens' Network Newsletter

For further information, please contact
CEE South through the 'Garbage to Gardens Network'

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RETURN DATE SLIP

DUE DATE	DUE DATE	DUE DATE
21 APR 2008		

Supported by : **Royal Norwegian Agency for Development Co-operation** **NORAD**
Australian Agency for International Development AusAID
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